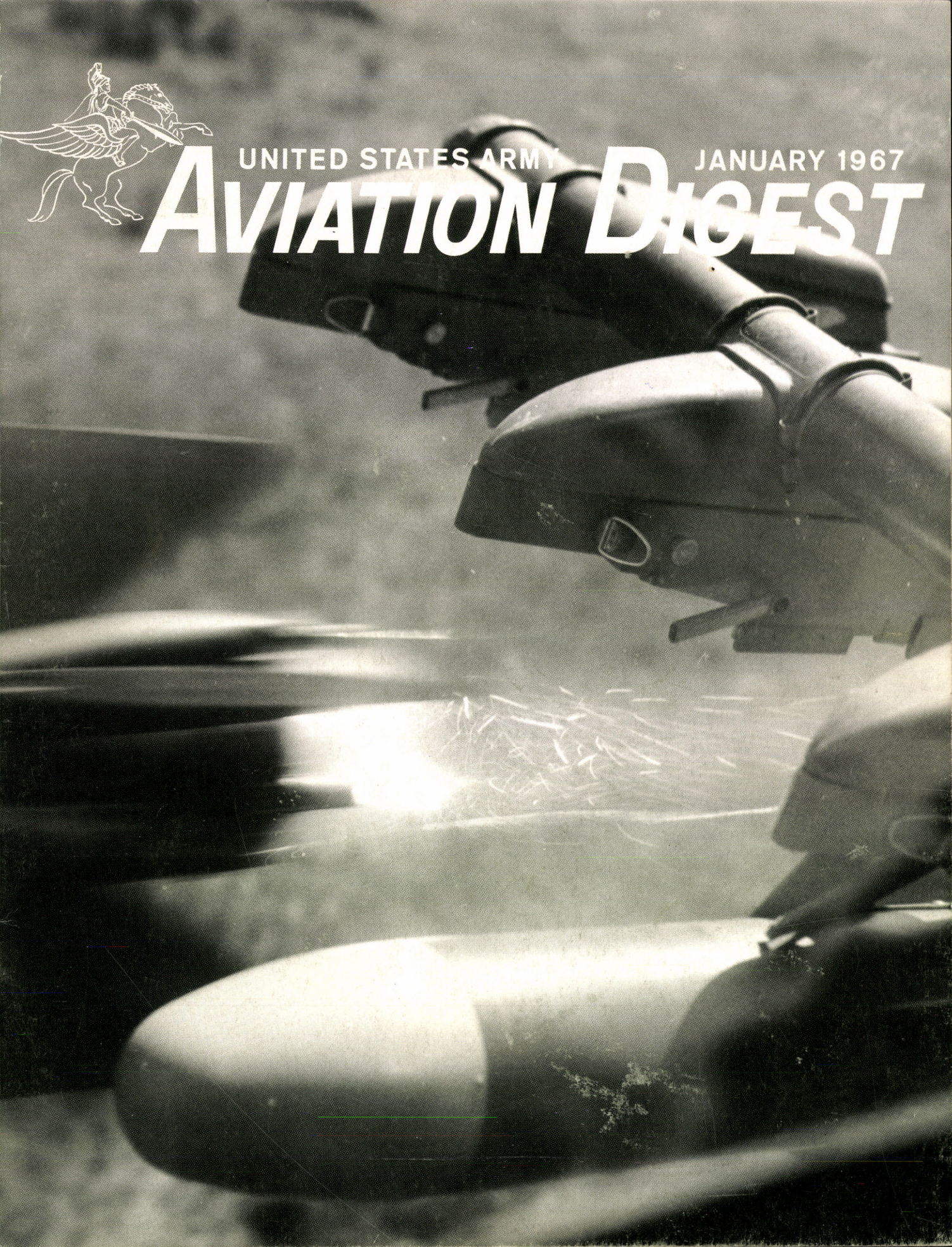
UNITED STATES ARMY

JANUARY 1967

AVIATION DIGEST



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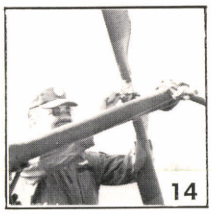

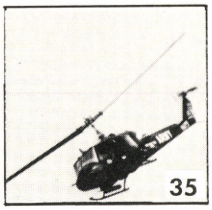

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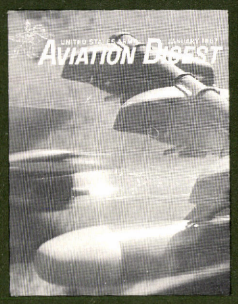

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The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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CAREER OUTLOOK

For Commissioned Army Aviators

Lieutenant Colonel Walter F. Jones

TWENTY-FOUR years ago Army liaison pilots were asking the same questions commonly asked by Army Aviators today. What future does Army aviation have for me? When will I attend my career course? What effect will nonparticipation or postponement of the career course and category III branch material duty have on my chances for promotion and selection for other schooling?

The answers we received 24 years ago were very similar to those we receive today, with the important difference being the basis of thinking backing the answers then and now. During the period 1942-1946 answers to our questions were based largely on hope and vision and very little on past experience and trends. Today's answers are also based on hope and vision, but more than that they are based on 24 years of valuable experience and definite trends which shed considerable light on the path ahead for Army aviation.

Army liaison pilots during World War II had difficulty being accepted as Army officers. In other

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COL Jones is commanding officer, 145th Combat Aviation Battalion, in the Republic of Vietnam.

A 'can-do' attitude brightens the career outlook

than pure artillery or aerial observation missions, our voice in the tactical plan or operation was not heard and to a large degree was undesired. We were considered only as flyboys.

Today the Army Aviator is accepted as a professional Army officer. His opinions are felt and heard, and I might say heeded, in almost every facet of Army activity—from the office of the Joint Chiefs of Staff down to the separate artillery battalion and from small combat development agencies to international organizations involved in research testing of multiuse high performance aircraft. The Army Aviator has matured, grown in stature, and has firmly entrenched himself throughout the entire Army. Based on the solid accomplishments and integration of Army aviation during the past years throughout the spectrum of Army activities, there is every reason to believe that Army aviation will continue to grow and develop with the future.

The military have been required to conduct their global activities within the personnel resources available to the active Army. This places the burden with its associated career turbulence on us. So be it. We are soldiers of the United States Army and are expected, and rightly so, to make the most of the situation. We have been through rough times before which affected our careers, such as World War II, the Korean War, and the Berlin buildup. Army Aviators have always fared well following these rough spots in our history, and there is no reason to believe the post-Vietnam era will be any different.

The current personnel and career turbulence affecting Army aviation is well known throughout every level of the Army and the Department of Defense. Positive actions have been taken to minimize the turbulence created by the shortage of Army Aviators and restore the accepted career normalcy as soon as possible. The two aviation training bases have been expanded and a new subbase formed at Fort Stewart, Ga., to increase the output of new aviators. Positive results from this expansion are evident. Continuous planning and steps are being taken to make the military a more attractive career which should increase the retention rate of the younger officers, thereby reducing the overall shortage of Army Aviators.

By direction of the Chief of Staff, United States Army, a letter signed by Major General Delk Oden (an aviator), Director of Officer Personnel, Department of the Army, is being placed in the official adjutant general file and the career branch file of every aviator below the grade of lieutenant colonel. This letter is addressed to anyone who would look at and evaluate an aviator's file for any reason, but primarily is for the purpose of selection for promotion and schooling.

This is a full page letter, very well written, describing the reasons an aviator may not have had the schooling and varied assignments, including category III branch material duty, that is normally present in the ideal career pattern. The reasons presented are not excuses but stand on solid military necessity. Performance of duty in positions calling for a lower grade is also discussed. Basically the letter directs each evaluating individual to recognize the turbulence in aviator careers and the reasons creating it and to focus their evaluation on the manner and degree of performance the aviator exhibited in his assigned duties.

With the emphasis steadily increasing for combat organizations that are airtransportable and/or airmobile, it should be evident to all active Army Aviators that their talents are going to be more and more in demand. Army aviation has not come of age, as many persons state; it's just now really beginning to grow. An aviator with a background of practical knowledge of the many facets of airmobility, plus common sense, and an attitude of wanting to really perform and get ahead cannot be held down. Success in command or high staff positions is based to a tremendous extent on willingness to work hard, listen hard and learn fast, and to a much lesser extent on the fact that certain schools were attended or certain jobs held at the proper time during the officer's career.

The Army Aviator should take advantage of every opportunity to improve himself generally and professionally; be aggressive in pursuing knowledge. He should enroll in his career branch and the CGSC extension courses and advance his civilian education level whenever the opportunity presents itself. During periods of career turbulence it is even more important that he make maximum use of the opportunities and sources that are available by exercising his initiative for advancing himself. This can be done by acquiring a positive "can-do" attitude and being professional in all endeavors. The aviator's future in the Army and in Army aviation is good; how good will be determined to a great extent by his own attitude, performance, and individual determination and initiative.

WA HOPPEN?

Lieutenant Terry W. Inman

The trees slowed the O-1 but did not soften the crash

OCTOBER 15, 1965 was just another routine day in the life of a Bird Dog pilot, or was it? What did fate have in store for that tiny metal plane and the brains behind the stick?

Early in the morning I received notice that I was to be attached to an advisory team at Ham Tan, South Vietnam, for a day. So like all aviators I climbed into my ship and flew the 30 miles to offer my services. Today was rang-rang mission day (all administrative).

Upon arriving at Ham Tan I picked up an NCO who had torn the cartilage in his knee and flew him down to the hospital at Vung Tau. My orders were to fly him there the fastest way and to take my time on return to take a close look along the coastline for any Viet Cong activity. Charlie wasn't showing himself this morning, so after flying over the area for two hours, it was time for chow.

That afternoon the S-2 was scheduled to be in Bien Hoa to talk over plans with the G-2, so I loaded the major into the back seat and off we went. A pretty day and a nice relaxing ride; even Hanoi Hannah wasn't raising too much steam over the ADF. The ride there was uneventful and our recon along the route showed only a few new traces of Charlie. Upon landing, the major went to his meeting and I told the crew-chief to top off the tanks and check the oil.

Two hours later, with the meeting over and the major ready to go, I helped him into the aircraft and ran a preflight. The tanks were full and both caps on secure-

Today was rang-rang mission day

ly. Next the cowling. A quick look at the oil level, a glance at the oil cap, and . . . oops something wrong here. The crewchief goofed and forgot to put the safety pin in the oil cap. #@$$@# There now; that fixed it and the pin is in place. Time to go. We break ground at Bien Hoa and head east to Ham Tan. And that is where my memory ends until the next morning in the hospital.

What happened you ask. Well here is the story that I've been able to piece together.

About 45 minutes from Bien Hoa, and only 5 minutes from safe ground at Ham Tan, the aircraft shuddered and the engine started to run rough. I called into control at Xaun Loc and reported that I was having engine difficulty and would try to make it into Ham Tan strip, which I had in sight. I estimated the distance as about 5 miles (later reports showed actual distance about 10 miles). Within a few seconds after reporting engine trouble, I was again on the air saying MAYDAY, MAYDAY, MAYDAY. The engine had just quit.

I again reported my position and tried to restart the engine. No luck; it had seized. Just before the stoppage when the engine started to run rough, I reached up and changed the fuel and glanced at my engine instruments. All were OK, but wait a minute; the oil pressure gauge that had just been in the green jumped and fell to zero, back up to the green, then down again, and there it stayed.

Emergency procedures, talk on the radio, try to restart, look for a place to land. A million things to do and a short time to do them. You can't pull over and park on a cloud, no matter how much you might like to.

A short explanation of the terrain. Picture flat land to the right ending at the ocean, and two small mountains to the left. Vegetation all jungle, trees 150 to 200 feet high. And you guessed it —that was all Charlie's land. I doubt if a friendly had placed a foot there for 20 years. Excelsior, a clearing below. I'm too low to jump and will have to try and land it.

So over the mike I see somewhat of a clearing below, will try to land in it. I check to see that my passenger is strapped and locked in tightly. Give him final instructions. Tighten my own straps and lock in. I look at the magnetic compass and give a bearing from the strip at Ham Tan to the clearing. I am talking constantly now, giving revised readings from the compass and trying to give distinguishing landmarks.

I'm setting up my approach. It's a large clearing (?) but only a small area free of trees to try for. Damn it's small! I drop the flaps; it is too late now to do anything but pray. It is too small to land like a fixed wing. How can I slow up enough to act like a chopper, and bring it almost straight down and still control the aircraft. Try to skim the tops of the last few trees as I'm on short final. My last radio transmission is to say, "I'm beginning to hit the trees. See you soon, I hope."

A thought runs through my mind, "A crash into trees with the flaps down may drive the flaps back through the observer's seat and decapitate him if the wings are torn off." I've got enough time before I hit the ground to raise them. Battery switch on, flaps up, switch off. Touchdown, nice. The trees slowed me down some, but not enough. I've still got too much forward motion. Looks like that tree on my right wing may slow me down . . . CRASH!!! Cartwheel time. Unconscious 5—10—15 minutes—maybe more.

The last coherent thing I'm credited with saying is "Get out; it may burn." I'm alive, got to get out of the aircraft, or maybe I'm already out. Did the major pull me out or did I crawl out by myself? Ouch, I hurt; can't talk too well either. Well now what's this pain in my head—wet.

The next 45 minutes are lost to me. As yet I haven't had much explanation as to what happened, except that the major and I walked (suspect he kind of dragged me) about 1,000 meters out of our small clearing through the jungle and into another small clearing. At some time we heard the search aircraft overhead and somehow found the second clearing from which to attract the attention of the searchers overhead.

As I mentioned before, this was all Charlie's land. Not knowing how long or if the search aircraft would find us, we decided not to wait around the wreckage for Charlie to give us a helping hand and headed towards friendly territory.

Only 45 minutes to find us is a surprisingly short time, considering the closest aircraft was 30 minutes away at Xaun Loc. The Army Bird Dogs got there first and started the search. Not only the Army was present, but the Air Force was there also, in the form of two Bird Dogs, some A-1Es, several F-100s and some more jets on the way to give some extra firepower if needed. The Army's addition to firepower was a light fire team, a couple of slicks, and a heavy fire team was a short dis-

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LT Inman was OIC, O-1 Section, Single Engine Fixed Wing Branch, Dept of Maintenance Training, Ft Rucker, Ala., when he wrote this article.

tance away. I was told that there were more aircraft on the way that I haven't even listed.

Members of my own platoon were the first to find the remains of the aircraft and, five minutes later, the remains of us. They called in the choppers, and the division commander's own ship came in and picked us up. They say that both the major and I came running out of the jungle to the settling chopper with great big grins. Needless to say, almost before we were strapped in we were headed for Saigon and the hospital.

In the meantime several of the armed choppers zeroed in on the broken Bird Dog with their machineguns and set her afire with tracers. It was too late in the day to try to pull it out for salvage (if there was anything worth salvaging). Thus the death and cremation of a gallant machine.

After Accident Report:

Injuries to your pilot were a fractured mandible, suspected

"I'm beginning to hit the trees . . ."

skull fracture somewhere over the left eye, deep facial laceration running from the ear along the jaw line to the point of the chin. Deep laceration over the left eye along the eyebrow and blow to eye caused a temporary (6 weeks) fixed pupil. Several deep lacerations to the legs. Amnesia for a period slightly in excess of 14 hours. Blow to jaw caused several of the front teeth to be knocked loose or imbedded in the lip, necessitating surgical removal. Damage to the 5th cranial nerve caused paralysis and loss of feeling to lower portion of mouth and jaw.

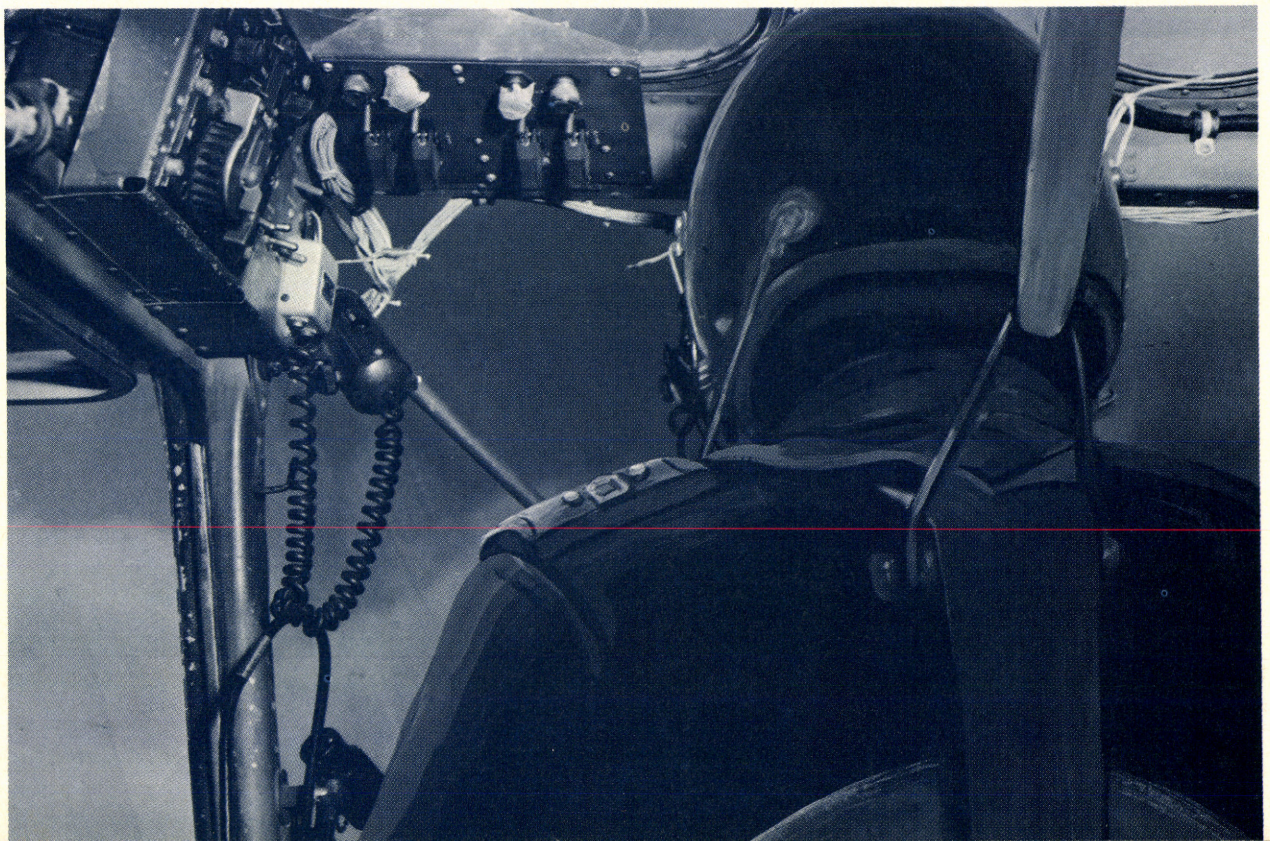
The observer received minor cuts and a sprained ankle. Further reports through the grapevine say that his knees were jammed, causing him to hobble around with crutches.

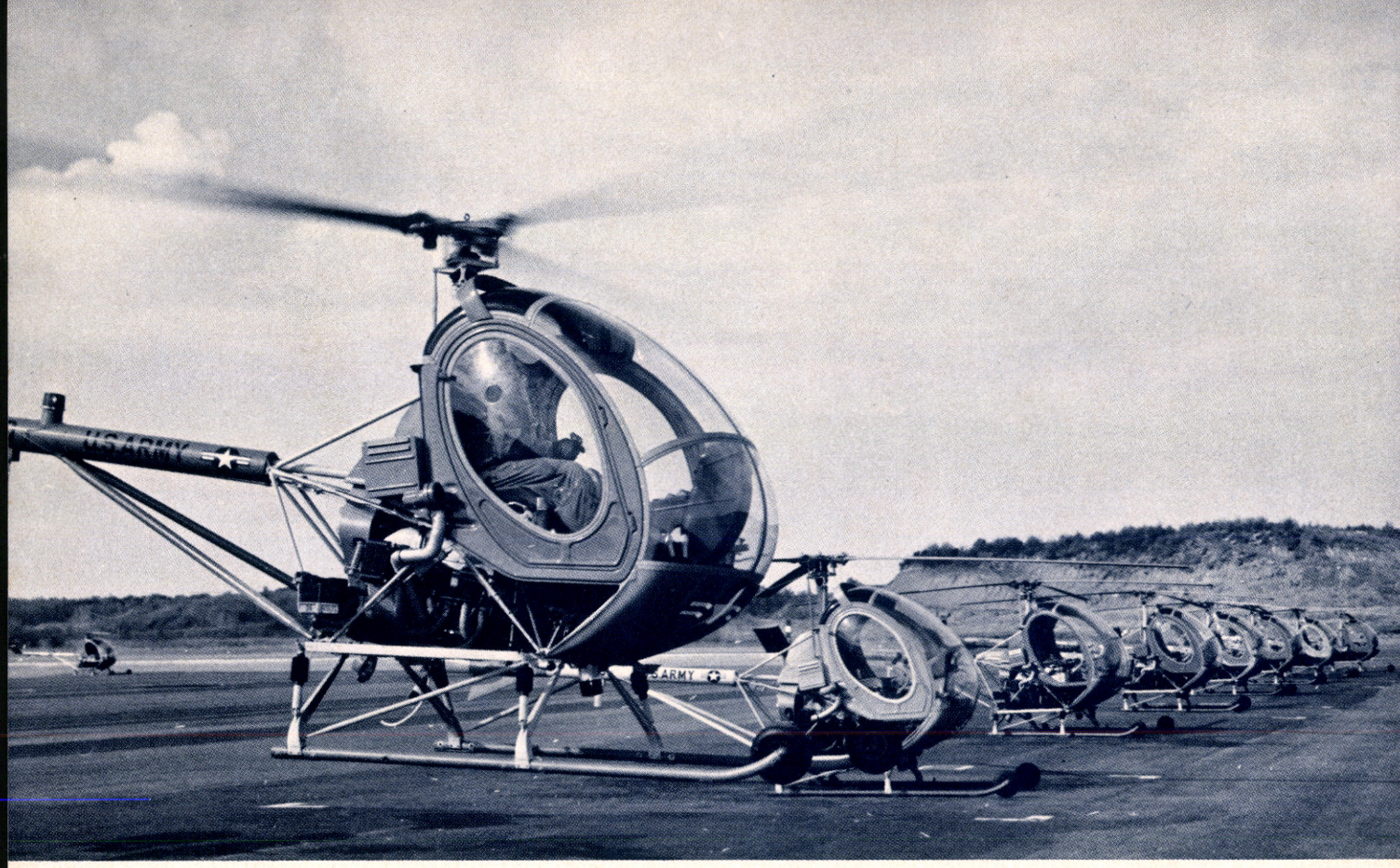
The major was observed overnight and released the next day. I was kept at Saigon for three days where they put my poor face back together. When it was safe to air evac me out, I was sent to Okinawa. Three months later after recuperating from the injuries, I was shipped back to the beautiful United States.

Cause of Accident as found by Accident Board:

Engine was recovered a few days after the accident. Cause was not definitely determined. There were two bullet holes in the engine, and the oil filter cap was not attached. Ah ha you say; oil cap off, pilot error. But wait a minute, the pilot said earlier he found the safety pin out of the oil cap and had replaced it himself. So, if the pin was in at the start of the flight, how did it come off and why? I guess no one will ever know. Do you have any ideas?

I knew a crash into trees with flaps down could drive the flaps back through the observer's seat and decapitate its occupant





Boom On The Brazos

Major Clarence H. Woliver

PRIVATE Johnathan Belt, C Troop, 56th Cavalry Brigade, Texas National Guard, stood on a slight rise of the ground and surveyed the scene around him. Located on land recently acquired just east of Mineral Wells, Texas, he saw the vast expanse of this 1925 blue sky interrupted infrequently by a few cloud puffs and an occasional buzzard looking for his supper.

Can you imagine the brain-puzzling surprise and utter disbelief that would occur if we could give Private Belt a look at the same sky 40 years later? The sky around Mineral Wells is now dotted—no, almost covered—with whirring, buzzing helicopters. Even the experienced aviator is awed by his first glimpse of this emphatic proof of the increased air activity here.

During World War II Camp Wolters housed 30,000 men in the nation's largest Infantry Replacement Training Center. Since 1956, primary helicopter training has been a part of Fort Wolters and vicinity. A civilian contractor, Southern Airways of Texas, Inc.,

MAJ Woliver is an assistant flight commander at the U. S. Army Primary Helicopter School, Ft Wolters, Texas.

Early in World War II infantrymen underwent basic combat training at Camp Wolters, then the United States' largest Infantry replacement training center

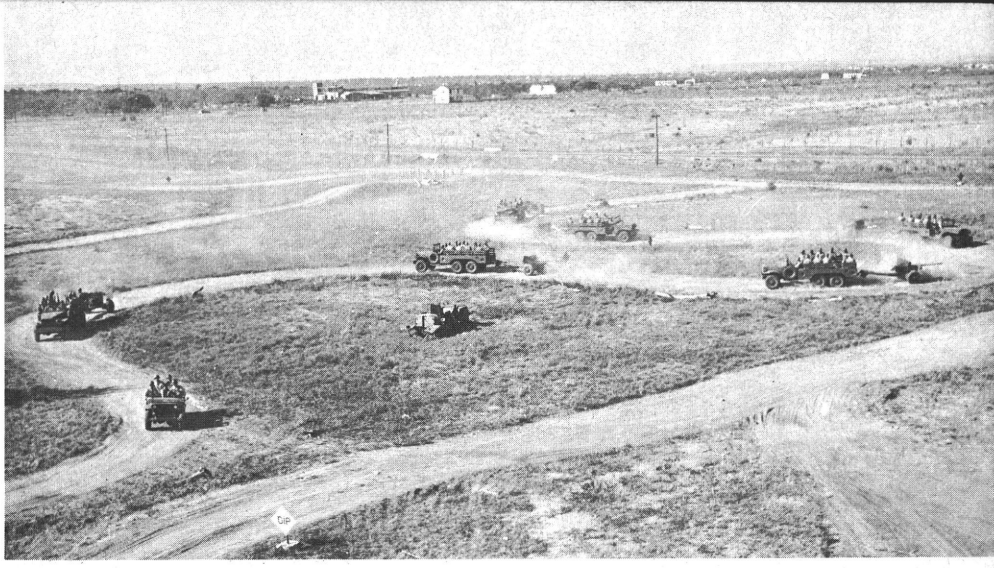
has been responsible for the lion's share of training. The first class graduated from Camp Wolters in April 1957.

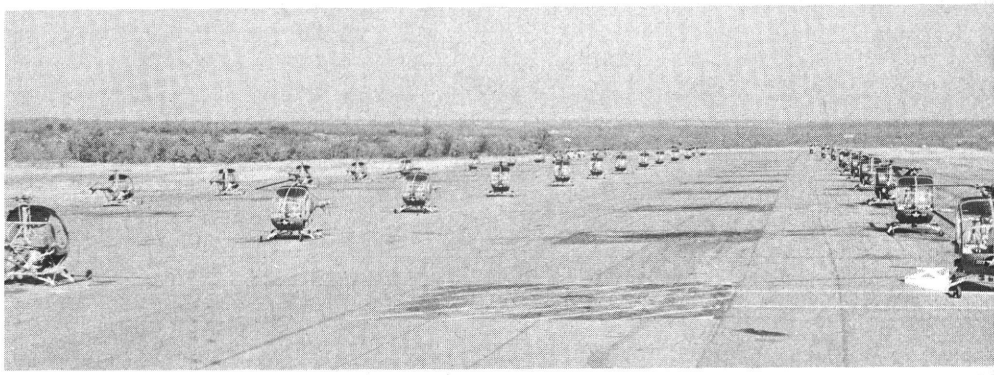
Before the first class of FY 66, training was split on a 12/20 ratio with the Aviation School at Fort Rucker. Twelve weeks were spent at Fort Wolters learning basic flying skills in an 85-hour flying program. An additional 125 hours at Fort Rucker were completed in a 20-week period.

The FY 66 training program was changed to provide for 16 weeks of flight training at both locations. This enabled Fort Wolters to devote more attention to "refining" the talents of all student aviators—mainly in night and navigation flight.

Concurrent with the change to the 16/16 concept was an expansion of student input that required numerous changes in training procedure. Instruction, formerly conducted solely by the contractor, was split between the contractor and Rotary Wing Division (now Military Flight Division). Fifty flight hours (contractor) are used to take the wide assortment of experience, and inexperience, found in officer and warrant officer candidate classes and mold this into the knowledge required of an Army pilot in basic primary stagefield-type maneuvers. After this primary stage, students are exposed for 60 flying hours to the experience of a preponderance of Vietnam veterans to learn the fine art of confined area and pinnacle operations, day and night navigation, formation flying, and night flying in general. This advanced phase sends the new pilot well along the road to being an Army Aviator!

The Primary Helicopter Center is now adjusting to the 16/16 concept and to the requirements generated by an expansion of student outputs to 290 per month. Plans hardly began to jell until further expansion called for student outputs to be 386 per month (375 program) by the end of 1966.

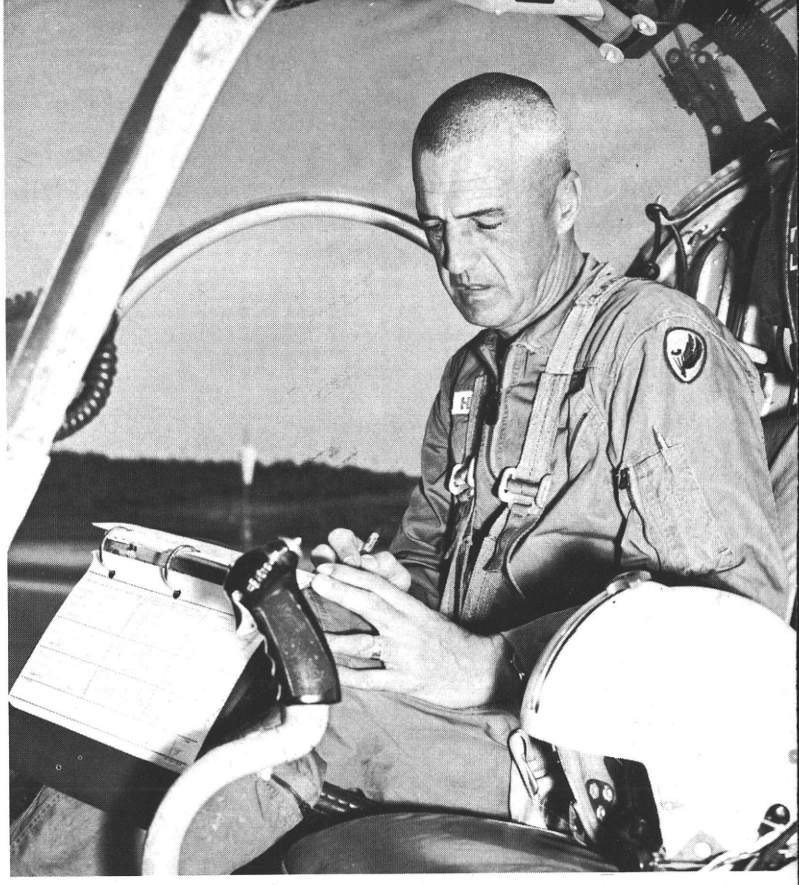




During World War II Camp Wolters' real estate thundered to the sounds of soldiers training for war such as the trucks (top) traveling the "Burma Road." Today at Fort Wolters, soldiers are still training, but in helicopters such as the TH-55 (above) rather than trucks. The post was named for BG Jacob F. Wolters who posed for the picture at the right on his horse "Red Bird" at the end of a 150 mile march in 1926.

An appreciation of the impact might be best obtained by looking at what was and is needed to accomplish the mission here. Our old student output of approximately 100 per month was supported by 140 civilian instructor pilots, 196 aircraft (OH-23), the main heliport, and five permanent stagefields.

To graduate 290 students per month in a 16-week program, 490



instructor pilots and 569 aircraft are required—both OH-23 and TH-55. The contractor needs five permanent and five tactical stagefields, and military advanced training requires one permanent stagefield and two tactical refueling sites.

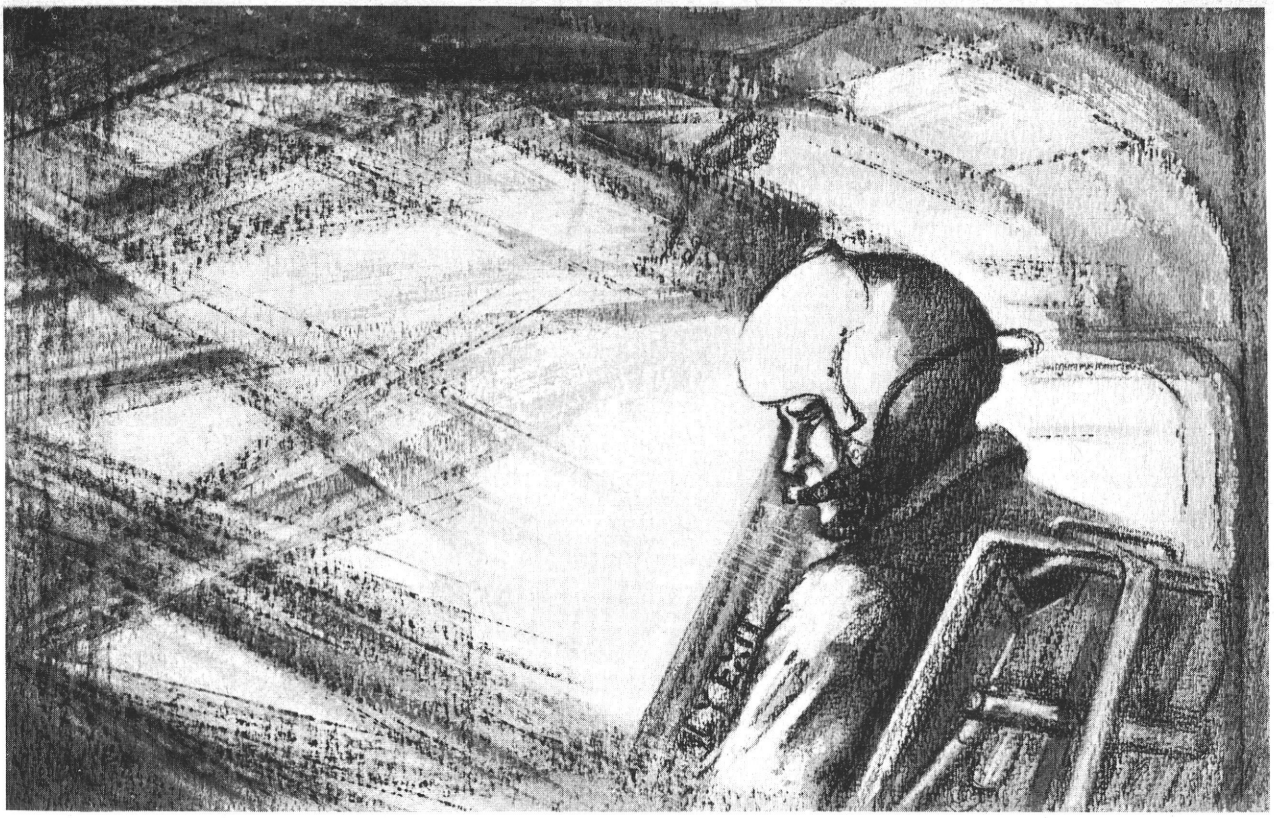
The 375 program is another story. Would you believe 585 IPs and 755 aircraft (a split fleet of OH-23 and TH-55)? A facilities increase to include an additional main heliport located adjacent to the Mineral Wells Airport, seven permanent and six tactical stagefields, plus two tactical refueling areas will dot the rolling "Mohair producing" territory around Fort Wolters.

What about the post proper? Unbelievably, the increased personnel have been absorbed without a major construction project. Conversion of World War II barracks has, thus far, satisfied the immediate requirements of the increase.

The students here were formerly all housed, fed, and corrected, if necessary, by the Student Company. Today, there is a Troop Command, which includes the Hq and Hq Company, Officer Student Company, and five Warrant Officer Candidate companies. The preflight portion of WOC training had only 70 candidates in residence in the past, but 385 will be the normal load in the near future. Again, to dazzle you with figures—compare the old normal number of 430 flight students in residence to the fall 1966 total of 2,120 (including preflight)!

Yes—everything at Fort Wolters is booming and suffering slight growing pains. Aircraft availability, training platoons of new instructors, real estate, barstool space at local taverns, an Officers' Club designed to support only a small percentage of the current officer strength, etc., are all problems of expansion. Ore is not the goal of this "Gold Rush"—just more and better qualified Army Aviators to meet the growing needs of today's mobile Army.

At upper left a student at the U. S. Army Primary Helicopter School at Fort Wolters preflights his TH-55. At upper right a student fills in an aircraft log book and, above, an instructor stresses a point.



The Unmental Fixation

GOSH BUT I'M tired," Lieutenant Leber said to himself as he slowly lowered his aching bones into his office chair.

It had been a rough day. He had to fly some visiting dignitaries to the firing range and wait in the hot sun until they were ready to come back. When he returned a multitude of little chores kept him on his feet the rest of the day.

Now, to make it even worse, Big Red, his colonel, wanted him to copilot/safety pilot for him while he brushed up for a helicopter renewal.

"Oh well," he thought, "nothing to do but follow the old soldier's advice and sleep when you can." With that he propped his feet up on his desk, reared back in his chair until his head rested against the wall, and went to sleep.

It seemed like only minutes until his shoulder was rudely shaken.

"Lieutenant, lieutenant. Wake up. The colonel's ready to go."

Lieutenant Leber got up with a groan and went out to the helicopter. Big Red was waiting for him. His unruly red hair looked redder than usual and his red mustache, usually kept small and neat, seemed to have grown in size and now reached out far enough to touch his ears.

"All right, boy, let's get this thing off the ground," Big Red said as he jumped into the right seat of the UH-1.

Lieutenant Leber didn't know if he said it or just thought it, but somewhere the idea went through his head that he was a fixed wing instrument examiner and not UH-1 qualified.

As if in answer he got the idea that Big Red was saying "No matter; having you here is only a formality."

As Lieutenant Leber climbed into his seat he noted that the lower right bubble was covered with translucent polishing liquid. All the other plexiglass was clean, however. For some reason or other, the polishing liquid didn't seem to bother Lieutenant Leber at all. It seemed natural for it to be there.

"Did you preflight, Colonel?"

"Nope; no time. Want to get off the ground before it gets dark."

This didn't worry Lieutenant Leber either. Nonetheless he did check the landing light, searchlight, and other lights. The landing light was broken.

They did some ADF work around Dumb Bell NDB then decided to go to a nearby Air Force base for a GCA and some

The Unmental Fixation

airway work. The controller there had a strange accent, and Lieutenant Leber guessed he was one of those foreign students in training.

The strange controller headed them east from the Air Force field. It was high overcast, no stars, no moon, not a light on the ground, no horizon—black as the inside of a crow.

"So what," Lieutenant Leber thought to himself, "the engine's running."

Down below were mountains. No roads. No cars.

"Sure is black below," Leber said.

Big Red didn't take his eyes off the instruments.

"Can't see a thing through that blasted polishing liquid," he said as a sort of an answer.

Leber glanced up at the rotors. A white light seemed to be shining on them.

"Colonel, look at that light. What is it?"

Big Red glanced up for a moment and then returned to the gauges. He only grunted.

Then things went Alpha Sierra. Big Red let the helicopter go into a bank and a climb. Lieutenant Leber didn't offer to help him clean up the dude. After all, this was his flight. He just let him earn his flight pay.

Some way or other they got through with the GCA and headed north again. They called home base for landing instructions and were cleared to an unlighted parallel taxiway. Their SOP for choppers called for searchlight (beeped full forward).

They were passing through 25 or 30 feet and going too fast. Big Red went blind as far as seeing outside was concerned. The bottom bubble was still plastered with cleaner, and dust was billowing everywhere. Reflection from the searchlight was terrible.

Then Lieutenant Leber heard himself begging Big Red to move left to a centerline he could see out of the dust. But Big Red paid no attention to him. His eyes were glued to some little reflectors alongside the taxiway. They were his only contact with the good earth, sorry as they were. He couldn't slow the beast down without seeming to settle.

When the stinger scratched lightly once he pulled pitch to climb, but the dust stayed with him. He went to the gauges momentarily and at about 100 feet saw lights and ground and lowered to a stop. He had also made an unintentional 180.

For some very strange reason Big Red seemed to think that he had to land, so he went down into the pit again and gingerly did a hovering 180 ending it with scraping skids. Grimly he lumbered to a hover again and herded that blinding light to a vast black parking area. He felt for the invisible ground, got it, and bottomed pitch. Then he called for a screwdriver to get his fist off the collective.

"Leber, Leber. Wake up. You youngsters just can't take it."

Lieutenant Leber opened his eyes, and there stood Big Red. They were back in the office. Lieutenant Leber shook his head and tried to figure out what had happened.

"Boy you look bushed. I don't think I ought to trust you to be my safety man tonight."

Then it all came back to Leber: he had been dreaming.

"No, I'll be all right. Just let me wake up a bit."

"You'd better wake up and get home to bed. I've been pushing you too hard. Besides, the bird's not ready. I just checked it. The landing light's broken, and someone quit work before he finished polishing the plexiglass. Left polishing liquid all over it. You go home and rest. We can fly tomorrow.

On the way home Lieutenant Leber kept thinking about his dream. What a juvenile mess it was. But maybe it wasn't so bad at that. It's better to have your messes in a dream than for real in the air.

Even in a dream, there is something to be learned. In this one he could see four lessons.

- The UH-1 searchlight is worse than no light for landing when dust is blowing. In his dream Big Red couldn't find his thumb to turn it off. In reality, Big Red had better sense than to go up without a landing light, in the first place.
- Under some circumstances hood flying at night is actual instrument flight. That being the case a safety pilot qualified in the aircraft and instrument qualified is needed. In his dream Leber was not qualified. In actuality, he was, and that is the reason Big Red had selected him to fly with him.
- A night autorotation by searchlight with dust and a covered bottom bubble is utterly impossible. Big Red didn't seem to know this in the dream. In real life he wouldn't touch the helicopter under these circumstances.
- The minute a sticky-wicket begins to develop a go-around, if possible, should be made. Being a good pilot, Big Red would simply pull pitch at the first inkling of trouble and ask for an approach to the lighted runway, land with the searchlight off, walk half a mile for ground handling wheels, and spend the rest of the night waddling the machine toward the barn. But that's better than spending weeks in the hospital.

MOON VALLEY

The Valley of 10,000 Smokes in Alaska is the closest replica to the surface of the moon that can be found on earth. Here 12 Army Aviators and a group of future astronauts took another step in man's journey to the moon.

ON ALASKA'S southwest peninsula, approximately 300 air miles from Anchorage, the tiny village of King Salmon nestles, surrounded by thousands of small lakes and marshy, grass covered fields.

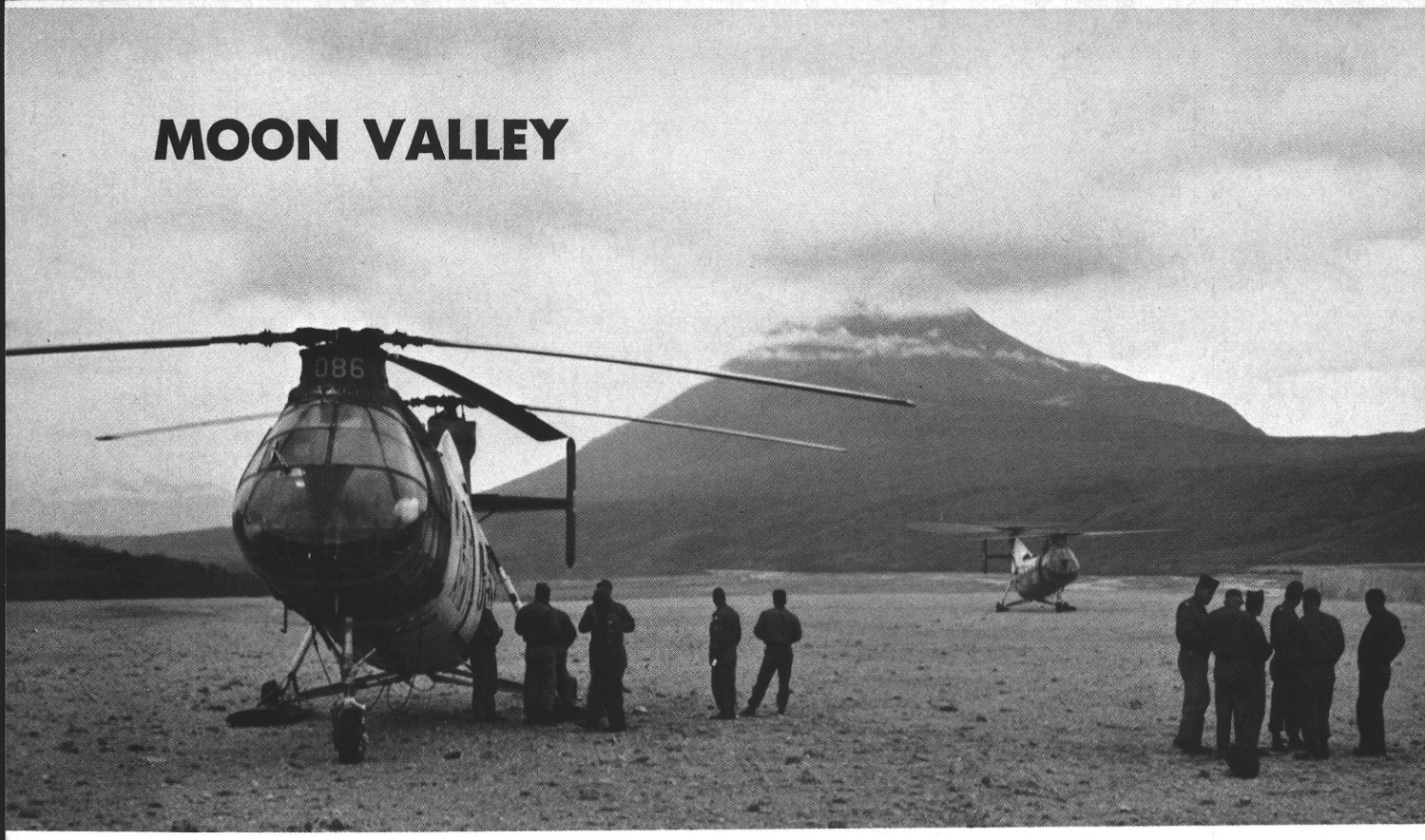
To this remote hamlet came 12 Army pilots, eight of whom were National Guardsmen on active duty for two weeks. Their mission was to provide transportation and support for visiting NASA (National Aeronautics and Space Administration) personnel who had come to Alaska in August for geological study.

Using King Salmon Air Force Station as a home strip, they shuttled the future astronauts and their instructors from the isolated Brooks Lodge in the Katmai National Monument area to the foreboding Valley of 10,000 Smokes for five consecutive days.

A simple taxi mission? Sounds pretty easy? Hardly!

The pilots were billeted at Rapids Camp, a small Air Force recreation area with the prime attractions of salmon fishing and huge insects. They had to drive to the Air Force Station each day, where their helicopters were based and serviced when not in use. From there, they began their flight

MOON VALLEY



to Brooks Lodge, over the towering peaks of the Aleutian Range to the eastern end of the Katmai Monument.

The Valley of 10,000 Smokes, the destination, is a volcanic end of the world which is all but devoid of vegetation, breeds no animal life, and is as inviting as the dark side of the moon. This is the reason it was chosen. According to all estimates, the valley is the closest replica to the surface of the moon that can be found on earth. The volcanic, lifeless surface, rocky and jagged, provided NASA personnel with exactly the type of training ground they had hoped to find.

It provided a vast collection of difficulties for the National Guardsmen, too. The surface of the valley is pitted with craters, scarred with the ice movements of the last 100,000 years, and dotted with small, flat plateaus which had to be used for helicopter landings. Getting six CH-21C helicopters to land on one of these windswept flats was often a hazardous job for pilot and passenger

Above: Army Aviators carry NASA personnel to all areas of the Valley of 10,000 Smokes. Below: Future astronauts and their instructors conduct geological studies.

alike. The threat of disaster often lay only a few yards from the 'copters skis, as the plateaus dropped off more than 100 feet to a sulfuric, rampaging river. Throughout the five-day mission, the pilots flew without serious mishap, handling their aircraft expertly. Fog, which hangs over the peninsula most of the year, provided reason enough to delay takeoff more than once. At Brooks Lodge, too, problems confronted the pilots. The lodge is accessible only by barge, yacht, or flying boat. Where to land a 13,200-pound helicopter with two whirling rotors was quite a problem, considering the dense foliage and almost total lack of flat surface.

The final decision was to put the CH-21s on two narrow stretches of beach which jut out into the bay. It required a good deal of maneuvering and occasionally having the tail of the craft hanging over the water, but it worked, nonetheless. The lodge had to send power boats out to that secluded stretch of beach, a few hundred meters away, and ferry NASA personnel and pilots to and from the aircraft.

There were difficulties which a pilot doesn't usually run across when he has a hard surface airstrip or open field to land on. Necessity provided the pilots with the answer to these and other problems which might have tried the patience of Job.

The pilots are a good example of the men in the National Guard. They are combination citizen-soldiers who are prepared, trained and capable of handling a military assignment on short notice.

One important point, the condition of the helicopters, was well summed up by a member of the Iowa National Guard. "These aircraft are on loan to us from U.S. Army, Alaska's 19th Aviation Battalion, . . . and are without a doubt some of the best maintained helicopters we have flown." Similar comments were forthcoming from other members of the pilot crews. The crewchiefs and maintenance personnel were cited for being truly professional and very competent in their jobs.

Before the pilots departed Fort Richardson with their aircraft, they were given a two day orientation on the CH-21C. It included an area orientation and flight standardization check, instructions on mountain flying, the peculiarities of Alaska weather and terrain, and the survival equipment and procedures used in the U.S. Army, Alaska.

The four active Army pilots who flew this mission with the National Guard pilots were all from the Rotary Wing Squadron at Davison Army Airfield near Washington, D.C. The four chief warrant officers, all veterans of Vietnam, and all on temporary duty for this mission, were well impressed with the performance of the guardsmen.

With the unparalleled problems which faced them during their mission, and the terrain which was unlike that of any other place on earth, the National Guardsmen proved that they were more than just "Weekend Warriors." They are fully qualified, highly competent professional pilots capable of handling the most difficult assignments.

The sight of a silver and red, twin-rotor helicopter climbing high over a volcanic plateau, with carbon-heavy smoke rising from three of the mountains surrounding it, is a vision which will justify anyone's faith in the reliability of the National Guard.

Terrain in the valley was windswept, rocky and pitted with craters which made landing a hazardous job (above). But the Army Aviators flew without a mishap and NASA personnel completed a successful five-day mission.

'New' Rotary Wing Qualification Course

Major Ralph V. Gonzales

The course begins with 25 flight hours in the OH-13 (above). Students learn about the OH-13 (below) before moving to the more complex UH-1.

WHETHER THE institution is a specialized school, college, or university, they all share in the common responsibility of graduating a product that has been carefully prepared and effectively groomed to meet the challenges of their chosen professions. The United States Army Aviation School shares in this common responsibility. Instead of preparing young men for the ministry, engineering, medicine, etc., the school is involved in the extremely delicate and urgent mission of producing officers, warrant officers, and enlisted men capable of taking their places as member of the Army aviation team in the Republic of Vietnam.

The attitude of the Aviation School toward this responsibility and its response to the huge demands for highly trained aviation personnel in Vietnam have been both healthy and commendable. In the modernization of the Army, aviation has played and will continue to play an increasingly important role. Already it is the largest and perhaps the most exciting of the specialized fields. However,

if Army aviation is to continue to deserve the confidence and support of all concerned, it must develop the capability of providing dependable, all-weather, around-the-clock support to the ground commander, when and where he wants it. Only in this way can the vast sums of money being spent on aviation be justified in terms of increased combat power.

As the center of learning for aviation, the Aviation School occupies a unique position. Through the efforts of this school, aviators acquire the "tools" for their trade; and the effectiveness or ineptness of courses taught at Fort Rucker can have far reaching consequences in the battlefields of Vietnam. In this respect, programs of instruction, course objectives, and the quality of instruction, are continually reviewed and validated as necessary to ensure that the end product is the best possible with available assets.

Since my arrival at the school in July 1964, I have witnessed many additions, deletions, and modifications to all rotary wing programs of instruction in an effort to improve the aviator product. In those cases where a program of instruction would not lend itself to modification, a completely new course was developed.

Such is the case with the "new" Rotary Wing Qualification Course. The "old" qualification course, with which most of you are familiar, was conducted at Fort Wolters, Texas, until the fall of 1965 when it was moved to Fort Rucker, Ala. The purpose of the course was to qualify fixed wing rated aviators as rotary wing pilots.

MAJ Gonzales was with the Operations and Training Branch, Dept of Rotary Wing Training, Ft Rucker, Ala., when he wrote this article. He is now serving in Vietnam.

Army aviation must develop instant, all-weather capabilities

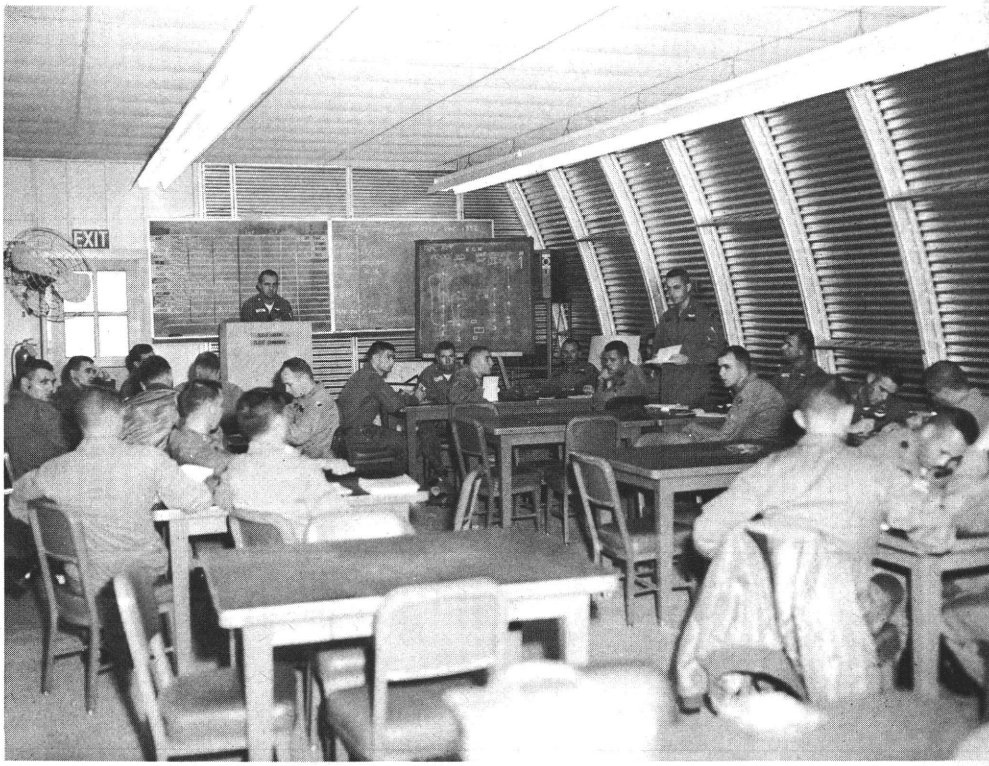
The majority of the students attending the existing (old) qualification course were en route to a helicopter unit in Vietnam with TDY en route to the qualification course. Upon completion of the qualification course, most students would continue to Fort Benning for the UH-1 transition before reaching Vietnam.

Entirely too much time was being spent TDY by students requiring rotary wing qualification and transition into the UH-1 aircraft. Even then, a void existed in this program, since students were not given instrument training. It was decided that the Rotary Wing Qualification Course could be improved to provide in one course all the training needed to qualify a fixed wing rated aviator as a rotary wing pilot.

The assistant commandant directed that a test be conducted with eight students from RWQC 66-5 to test the feasibility of developing a program of instruction that would qualify a fixed wing student in the following:

- Qualification in the OH-13 helicopter.
- Qualification in the UH-1 helicopter.
- Qualification in rotary wing tactical instrument procedures. Issue of a rotary wing tactical instrument card would be an objective of the course.
- Working knowledge of UH-1 aerial gunnery operations with M-5, M-6, XM-3, XM-16, and M-22 armament subsystems.

Students at Ech stagefield receive a flight briefing before taking to the air



'New' Rotary Wing "Q" Course

The purpose of the course would be to qualify commissioned and warrant officer aviators in rotary wing aircraft flying techniques; to qualify aviators in skills and knowledge necessary to operate rotary wing aircraft using tactical instrument procedures; and to qualify aviators in the UH-1 helicopter and in techniques required in air-to-ground helicopter gunnery operations.

Breakdown of phases and flight hours for the entire test were as indicated:

- 4 weeks, 25 flight hours, OH-13 Qualification.
- 3 weeks, 2 days, 21:15 flight hours, UH-1 Qualification.
- 3 weeks, 18:45 flight hours, Tactical Instrument Training, UH-1.
- 1 week, 3 days, 8 flight hours, Tactics Training, UH-1.

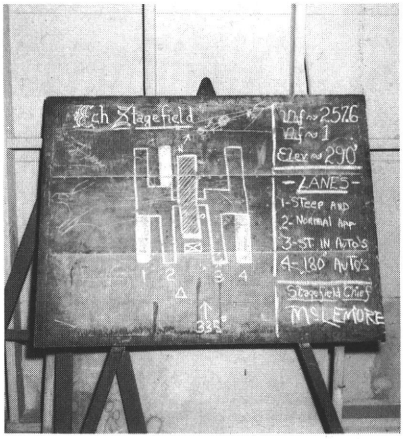
The test was begun on 28 March 1966 and completed on 17 June 1966. The results were much better than expected. Students were able to learn the basic fundamentals of helicopter flying in the first 4 weeks in the smaller OH-13 aircraft and were quite capable of going into the more complex and larger UH-1 aircraft. Standards Division, Department of Rotary Wing, conducted the training test for the UH-1 phase. Instead of administering the final UH-1 transition checkride themselves, it was given by the instructor pilots who conduct the 25 hour UH-1 transition phase for ORWAC/WORWAC. In this way, we were able to compare our test product at the end of 21:15 flight hours with an initial entry student at the end of 25:00 flight hours. If the test students could do as well on the checkride as the average initial entry student, we could consider the 3 week, 2 day (21:15 flight hours) UH-1 transition phase a success.

The test students did even better than the average initial entry student. According to the instructors who conducted the checkrides, the test students were as much as 10 hours better than the initial entry student at the completion of this stage of training.

Likewise, the tactical instrument phase of 18:45 flight hours (3 weeks) was an unqualified success. All flight students qualified for issue of a tactical instrument card, and three were issued standard cards.

Upon completion of the test, USAAVNS recommended to USCONARC that it approve the new Rotary Wing Qualification Course as tested with one exception: 2 flight hours were added to the tactics phase, making it a 12 week, 2½ day course with a total of 77 flight hours. The course was approved by DA, and USCONARC subsequently directed USAAVNS to implement the new Rotary Wing Qualification Course with the class to report to USAAVNS on 3 November 1966.

While it was intended that the new course, if approved, would replace the old qualification course, DA decided to retain the old course for use by reserve component and allied students. The new course is designed to be used exclusively for qualification of active Army personnel. Significant



The new course provides the student with a working knowledge of various helicopter gunnery systems such as the M-5 (right)

features of both courses are summarized on the chart.

Although the new course is longer (4 weeks) and requires more flight hours (17 hours), it actually represents a considerable saving to the government. To give a student, after he graduates from the old course, all the qualifications he will get under the new course, it would require the following: upon completion of the old qualification course and 60 flight hours, the student would go to Fort Benning for 25 hours of UH-1 transition, and then back to Fort Rucker or elsewhere for approximately another 30 hours for tactical instrument training. This would require a total of 115 flight hours (as opposed to 77 flight hours) and probably up to as much as 5 months (as opposed to 3 months) to complete the training, if we consider the travel time involved.

Title of course:	Officer/Warrant Officer Rotary Wing Qualification Course (Reserve/Allied)
Number of Course:	2C-1981-A/2C-062B-A
Length:	8 weeks
Total flight hours:	60 hours
Aircraft used:	OH-13
Qualifications:	Rotary Wing Pilot, OH-13
Title of Course:	Officer/Warrant Officer Rotary Wing Qualification Course (Active Army)
Number of Course:	2C-1981-D/2C-062B-D
Length:	12 weeks, 2½ days
Total flight hours:	77 hours
Aircraft used:	OH-13 and UH-1
Qualifications:	Rotary Wing Pilot, OH-13 and UH-1 Tactical Instrument Rated Working knowledge of aerial gunnery operations with M-5, M-6, XM-3, XM-16 and M-22

This new course is not the final answer to qualifying fixed wing aviators as helicopter pilots for duty in RVN. Any new course will require modifications to eliminate the "bugs" and make the course more responsive to needs. However, demands in Vietnam and the qualifications required of new rotary wing pilots dictated a change, and the new course is certainly a step in the right direction.

A Check In Time

ON TAKEOFF the pilot of a light-twin detected "an unusual vibration or sound," he wasn't sure which, just before rotation. He aborted the takeoff and turned off the runway for further runup. During the full-power engine check, he discovered the static rpm on the right engine was 400 low. Suspecting a prop or prop governor failure, he taxied back to the line. Much to his surprise he was met by an excited line crew pointing fire extinguishers at the aircraft's right nacelle which by now was emitting a great cloud of smoke. The engine was quickly shut down, but since no flames were visible foam did not have to be used.

Upon inspection, the generator was found to be completely gutted, and all that remained in the case was the shaft and a handful of shredded wire-like material. The armature had completely disintegrated, and the case had broken an inch from the flange and rotated a full quarter of a turn. Evidently the rear bearing had failed and allowed the armature to contact the side of the case. The shaft had not sheared, as it had been designed to do, with the result that during runup this heavy friction had drained off enough horsepower to reduce the rpm by 400.

Had the pilot continued his takeoff, he would have been in trouble. A serious emergency could not have been avoided. The moral here is that all changes in sound, feel of the controls or vibration level should be investigated even though instruments indicate normal operation.

Flight Safety Foundation Bulletin

ANNUAL AWARD
Monthly Winner
CONTEST

INFLIGHT TAIL ROTOR FAILURE IN THE IROQUOIS

Major James W. Jay

IN DISCUSSION of how to handle a tail rotor failure in flight varied opinions fly hot and fast. Some aviators become violent in expressing their opinions on this highly controversial subject. The biggest reason for divergent opinions is that some aviators fail to realize that there is more than one type of tail rotor malfunction, or they attempt to lump all types of tail rotor malfunctions, into a single category with a single all-encompassing solution. This is impossible! Any proposal of a single emergency procedure for all types of tail rotor failure will meet with quick and valid opposition.

As a prelude to any discussion of the many aspects of tail rotor failure, an understanding of certain points must be firmly established. The purpose of the tail rotor system is to compensate for torque in the engine-to-main-rotor couple by providing control around the helicopter's vertical axis, using thrust delivered from the tail pylon. I say that its basic reason for existence is to hold the fuselage into the relative wind, which results from the direction being made good by the main rotor and from the existing winds (except for hovering and slipping requirements).

Most helicopter designs incorporate tail booms of inadequate size and configuration (in proportional relation to the flat plate area and weight of the cabin forward of the mast/center of gravity) to supply sufficient weather-vaning (streamlining) effect to permit properly controlled flight. This is true even in autorotation without torque. Aside from slight streamlining benefits, the only real purpose of the tail pylon on helicopters in the current inventory is

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to provide a mounting place and a lever through which the tail rotor accomplishes its mission.

In powered flight the tail rotor creates thrust to the right in proportion to the amount of left pedal and power (torque) applied. In autorotation the tail rotor creates thrust to the left in proportion to the amount of right pedal applied beyond that which creates zero tail rotor thrust. Very slight, right pedal must be applied to maintain balanced autorotative flight since the friction in the system tends to turn the fuselage around the vertical axis in

"Solutions" are numerous and varied

the same direction that the main rotor is turning. All these points must be fully understood before attempting to develop a standardized, safe, and acceptably reliable procedure to be followed in event of tail rotor failure, or in developing a system for simulation in pilot training.

In our thinking and discussing of the consequences and emergency procedures related to tail rotor failure, let's not lose sight of the fact that more than one type of failure can be experienced. First, there is complete failure of the drive system, which results in stoppage of the tail rotor and no thrust whatsoever. Second, there is the failure in the pitch control system that results in a fixed pitch setting with a static and uncontrollable amount of thrust delivered. At least, the amount of thrust delivered cannot be controlled normally with pedals. This is the type failure that occurs when a control cable is shot out and can result in one of three emergency flight configurations. Third, and most critical, is the loss of the tail pylon. In this instance, it may be a tossup as to which is most critical, loss of directional control, or center of gravity misplacement. Surviving a combination of these two problems is very difficult.

Complete loss of tail rotor thrust is a situation involving a break in the drive system, such as a severed drive shaft, wherein the tail rotor stops turning and no thrust whatsoever is delivered. In this instance it is likely that powered flight to a suitable area and execution of an autorotative approach is the proper emergency procedure. Failures of this type will always result in the tail boom swinging to the left (left sideslip) and a left roll of the fuselage along the horizontal axis.

In powered flight the degree of sideslip and the degree of roll may be varied by changing airspeeds and by varying power (throttle or pitch), but neither can be eliminated. Below an actual airspeed of approximately 40 knots, the sideslip angle becomes uncontrollable and the tail pylon may swing directly into the relative wind. In power-off flight (autorotation) the sideslip angle and the roll angle can be almost completely eliminated by maintaining an airspeed above approximately 20 to 30 knots. At low airspeeds streamlining effect is lost and the sideslip angle becomes uncontrollable. Upon pitch application at touchdown, the fuselage will tend to turn in the same direction the main rotor is turning (tail pylon swings right, opposite torque effect) due to an increase of friction in the transmission system. This turning tendency is very slight and sometimes unnoticeable.

Next in discussion is a malfunction involving a loss of control resulting in a fixed pitch setting, such as a severed control cable. Normally under these circumstances the pitch setting in the tail rotor at the time the cable is severed will remain in the tail rotor system. Whether, or how much, the tail pylon hangs left or right is usually dependent upon the amount of pedal (pitch) applied at the time the cable is severed. Regardless of pedal setting at the time of malfunction, a varying amount of tail rotor thrust will be delivered at all times during powered flight.

As we discuss the three different reactions that may occur upon failure of tail rotor control, bear in mind that the tail rotor pitch setting resulting from a malfunction may be variable, or could

suddenly shift from one fixed pitch setting to another. This could require the pilot to change from the initially selected emergency procedure to another.

If the tail rotor pitch becomes fixed during an approach or other reduced power situation (right pedal applied), the tail pylon will swing left when power is applied to an even greater degree than would be experienced with complete loss of tail rotor thrust, and the overall situation would be even more hazardous. The best solution would most likely be to autorotate immediately. Success of the autoratation would depend upon the amount of pitch applied at the time of malfunction.

If the tail rotor pitch becomes fixed during a takeoff or other increased power situation (left pedal applied), the tail pylon will swing right when power is reduced (as in leveling off with cruise power). This swing to the right upon power reduction will usually be to a lesser degree than the left swing encountered in any previously mentioned situation. Under these circumstances, it appears that powered flight to an airfield and powered landing could be accomplished with little difficulty since the sideslip angle will probably be corrected when power is applied for touchdown. However, upon decreasing power to initiate the approach at destination, the sideslip angle will increase and remain increased during the approach, but should be corrected to a great degree when touchdown power is applied. Due to sideslip increase upon reduction of power to initiate the approach, a higher than normal approach speed will probably be beneficial. In this instance, powered landing will probably be the best solution. It is likely that autorotation could not be accomplished at all.

If the tail rotor pitch becomes fixed during normal cruise power settings, the aircraft reaction will be quite similar to that described in the paragraph following. At actual airspeeds from 40 to 70 knots, the tail pylon should streamline with very little, if any, sideslip or roll angle. In this instance autorotation will probably aggravate the situation because a reduction of power (torque) may then result in a right sideslip. It must be considered however that an increase in power at touchdown will result in a left sideslip if powered approach is used, although this sideslip should not be of an uncontrollable magnitude for touchdown.

Loss of the tail pylon or a part of it would be a "hairy" situation at best. The gravity of the situation depends upon the amount of weight (how much tail pylon) that is lost. If the loss is small, such as aft of the 42° gear box, the situation would be similar to complete loss of tail rotor thrust. However, if more than that is lost, there may be no solution to the problem. Furthermore, experience limits our description of the efects described for complete loss of tail rotor thrust. In this instance immediate autorotation is probably the only solution, being a nebulous one at that.

Most of my discussion to this point can be substantiated to one degree or another by existing theory of flight publications, flight manuals, training circulars, aircraft manuals, etc. Up to this point, however, I have only established some points pertinent to the function of the antitorque system and benefits derived therefrom, and the fact that a malfunction of the antitorque system is a hairy situation at best. I have not really entered the realm of corrective actions; nor do existing Army publications—at least not satisfactorily.

For many years pilots of single rotor helicopters have been told that an immediate autorotation was the only solution for a tail rotor malfunction which results in loss of tail rotor thrust. This advice has been soundly based on the fact that removing main rotor torque eliminates the primary reason for having a tail rotor. However, I take exception to this theory as a hard and fast rule because the terrain over which helicopters operate is often unsuitable for an immediate landing. Many times it would be advantageous to be able to continue flight until a suitable landing area is located.

I am not the only loose-wing aviator who is beginning to realize that autorotation is not the only emergency procedure for tail rotor failure. Troops in the field (Vietnam) have come up with another solution and a method of teaching it. I fear, however, that this may be a case of going to the opposite extreme. Interviews with numerous recent returnees from Vietnam indicate that the powered approach and landing with a run-on type touchdown is being preached as the cure-all solution just as strongly as the immediate autorotation once was. I agree that landing with power is many times the correct procedure. However, I feel that a power approach and landing would be impossible, if not fatal, if used as an emergency procedure for some types of antitorque failure.

Among the units in Vietnam, one of the most widely used methods of simulating inflight antitorque failure and the emergency procedure therefore is to require the pilot to place his feet flat on the floor and execute a powered run-on approach and touchdown

It may be best to continue the flight

at approximately 20 knots airspeed, correcting sideslip by throttle movement. This technique has many fallacies but, with modification, could be made to simulate loss of tail rotor control during normal cruise.

Value of the technique is questionable in that the only effect of the neutral (free-floating) pedal situation is to approach simulation of failure at normal cruise. The use of pedals does not in any way approximate the effects of complete loss of tail rotor thrust; nor does it simulate the effects of any malfunction other than fixed pitch setting occurring at normal cruise. Effective consideration is not given to the many and varied aspects of tail rotor malfunctions, thereby channeling the students' thoughts and reactions in a single direction that could further enhance the possibility of a major accident in the event of an actual tail rotor malfunction during flight.

The solution for one type malfunction, if applied to a different malfunction, can guarantee the occurence of a major accident. The fact that some actual instances of antitorque failure have occurred when this emergency procedure was used successfully is not a satisfactory proof of the technique. How many times has this technique been attempted unsuccessfully?

Army Aviators are not the only ones interested in the problems evolving from antitorque malfunctions. The U.S. Navy, in conjunction with Sikorsky Aircraft Division of United Aircraft Corporation, has conducted rather extensive flight research in the realm of "zero tail rotor thrust" (April 1964 APPROACH magazine).

As a result of these tests, Navy flight manuals are being revised to recommend the following inflight emergency procedures for complete loss of tail rotor thrust: Continue powered flight to a safe landing area; make a full autorotative landing, securing (switches off) the engine when the landing area is assured. During the descent an indicated 60 knots should be held. If the landing area is a level, paved surface, a run-on landing between 20 and 30 knots can be easily accomplished. If the field is unprepared, start to flare at about 75 feet, holding it so that forward groundspeed is at a minimum when the aircraft reaches 10 to 20 feet. A rapid collective pull just before touchdown in a level attitude will complete a

Inflight Tail Rotor Failure in the Iroquois

successful handling of a difficult emergency situation. (In conducting the flight tests ,the Navy used its version of the CH-34.)

In arriving at its recommended emergency procedure, the Navy considered that landing with power produced a high possibility that the helicopter would incur severe damage on touchdown because of the attendant sideslip angle. (This may be an even more important consideration in a skid geared ship.) A further consideration was that an autorotative approach had the advantage of a functioning airspeed system in the descent, thereby negating further hazard from an uncontrollable/undeterminable airspeed.

I agree with the Navy's procedure wholeheartedly. However, I hope they have an emergency procedure for tail rotor malfunctions other than complete loss of thrust. I would hate to see the result of an autorotation with the tail rotor delivering a constant thrust to the left. What happens when in the deceleration to touchdown?

If there is one single item that dictates success or failure in handling a tail rotor malfunction, it lies in the pilot's ability to quickly and correctly analyze the emergency situation. (What has happened to me? Is the tail rotor still turning? How much, if any, pedal control do I have? Is there c. g. problem? Will the aircraft streamline for further powered flight? If so, what is the best airspeed and power setting for this particular emergency?)

If the situation (altitude) permits, immediately reduce collective pitch (power) as an assist in gaining maximum possible control (trim) of the aircraft under existing circumstances. Altitude permitting, plan to reduce collective pitch to the full down position. Rolling off power (throttle) is not considered necessary at this time. Reduction of power should not be abrupt because the power reduction might further aggravate the out-of-trim circumstance or dictate an immediate return to powered flight, i.e., if the pitch is fixed in a "left pedal applied" position.

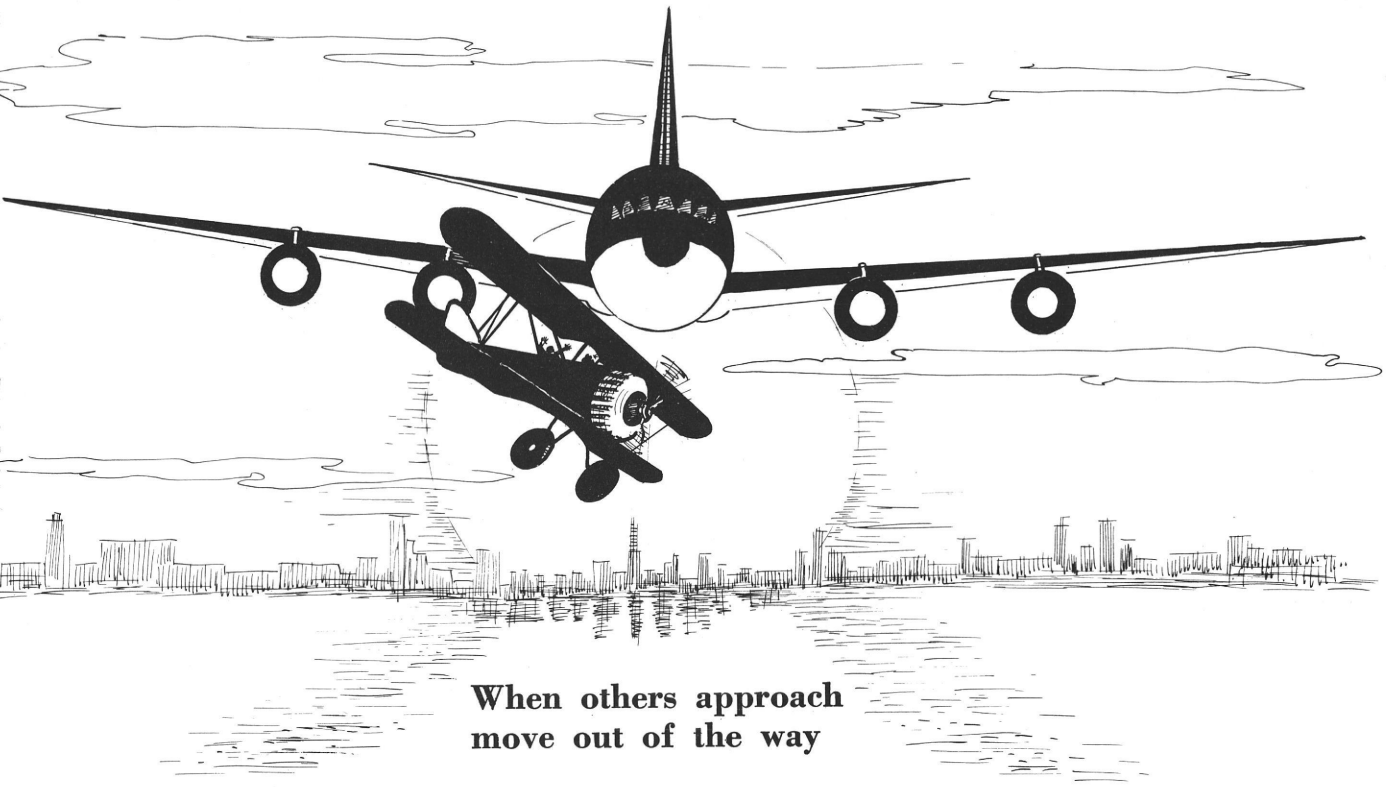
The pilot should immediately analyze the existing emergency to the best of his ability before taking further action. He may elect to autorotate immediately to a secure and improved landing area, if such area is available. This should be accomplished where possible under all circumstances, except when tail rotor pitch is fixed in a "left pedal applied" position.

If a safe landing area is not immediately available, continue powered flight to a suitable landing area by gradually applying power to assume a level powered flight circumstance with an airspeed dictated by the limitations of the emergency condition. This airspeed should be that which is most comfortable to the pilot between 40 and 60 knots indicated. This will be somewhere between 50 and 90 knots actual airspeed, dependent upon the degree of incurred sideslip and roll. Do not fail to consider that, in addition to decreasing the sideslip angle, increased airspeed increases the roll angle.

When the landing area is reached, make a full autorotative landing, securing the engine (switches off) when the landing area is assured. During the descent an indicated 60 knots airspeed should be maintained and turns kept to an absolute minimum. If the landing area is a level, paved, surface, a run-on landing with a touchdown airspeed between 15 and 25 knots should be accomplished. If the field is unprepared, start a gradual deceleration flare about 100 feet, holding pitch attitude so that forward groundspeed is at a minimum when the aircraft reaches 10 to 20 feet. Execute the touchdown with a rapid collective pitch pull just before touchdown in a level attitude with minimum ground roll (zero, if possible).

If the pilot has determined that the tail rotor pitch is fixed in a "left pedal applied" position (tail rotor delivering thrust to the right), autorotative landing should not be attempted. He should reinstate the aircraft in a powered level flight circumstance at a comfortable airspeed which will be dictated by the degree of sideslip and roll. Continue powered flight to the nearest improved landing area and execute a running landing with power and touchdown speed between 25 and 40 knots. In this approach, the sideslip angle will be corrected to some degree when power is applied to cushion the touchdown. However, upon decreasing power to initiate the approach to the landing area, the sideslip angle will increase for the duration of the approach but should be corrected when touchdown power is applied.

Before beginning the approach, the pilot should roll off throttle to obtain approximately 6200 engine rpm, leaving the governor selector switch in the AUTO position. This will permit the pilot to control yaw to some degree by increasing and/or decreasing throttle without the danger of compressor stall or surge that is inherent with operation in emergency governor. As an alternate method the pilot should consider leaving the throttle full open with the governor in AUTO and using the INCR-DECR switch to control yaw.



When others approach
move out of the way

Thoughts From The Past

Major Malcolm G. McDonald

I RECENTLY SAW a rather amusing motion picture entitled "Those Magnificent Men in Their Flying Machines," which dealt with the London to Paris air race around 1910. Then I saw another picture entitled "The Great Race," which dealt with all forms of transportation around 1920. I got to thinking just what kind of men would fly in balloons and aircraft of that period and love every minute of it.

By present day standards, the aircraft of the period before and after World War I were dangerous in nearly every respect. It was nothing for an engine to quit at any time during takeoff, climb, cruise, descent or landing, and then it was every man for himself. Sometimes aircraft wings, tail sections, etc., would fall off at the most embarrassing moments.

In my reminiscing, I ran across a set of flying rules circa 1920, which were published for the Army Air Force-Signal Corps aviators then in the intrepid flying business. Probably some of you have seen this list, but for those who haven't let me pass them on to you with some editorial comment after each one. After all, you have come this far in the article so what are a few more paragraphs give or take a couple. Here are my "thoughts from the past":

MAJ McDonald is project officer, Studies, Research and Analysis Division, Dept of Tactics, Ft Rucker, Ala.

Thoughts From the Past

It may be fun, but riding on the tail of the machine is prohibited

Rule # 1. Don't take the machine into the air unless you are satisfied it will fly.

You know this sounds familiar, like something I have heard before from a few instructor pilots I have known.

Rule # 2. Never leave the ground with the engine leaking.

How many times on the flight line have I heard some of our more illustrious aces say, "Aw what the heck, that's just a minor oil leak; forget it. Let's get going. How can I get my 4 hours sitting on the ground?"

Rule # 3. Don't turn sharply when taxiing. Instead of turning short, have someone lift the tail around.

Well the first part of this thought is all right. However, the second part might get a bit sticky in today's Army aircraft.

Rule # 4. In taking off, look at the ground and the air.

A good idea. It makes the takeoff so much better looking from the tower.

Rule # 5. Never get out of a machine with the engine turning until the pilot relieving you can reach the engine controls.

OK, and watch out for that propeller. It has a tendency to spit things out rather violently—like fingers, arms, etc.

Rule # 6. Pilots should carry hankies in a handy position to wipe off goggles.

Well if you don't wear goggles, you might try wiping off the outside windshield before starting up. It makes it so much easier to see where you are going.

Rule # 7. Riding on the steps, wings or tail of a machine is prohibited.

Yes, that's a good idea; it does get a bit windy in those positions.

Rule # 8. In case the engine fails on takeoff, land straight ahead regardless of obstacles.

You know I have heard that same expression of thought somewhere before. Pretty sound advice, I guess, to have stood the test of time.

Rule # 9. No machine must taxi faster than a man can walk.

Again that sounds familiar, though this rule is often ignored.

Rule # 10. Do not trust altitude instruments.

Especially if you don't set them properly in the first place.

Rule # 11. Learn to gauge altitude, especially on landings.

Now that sounds like VFR flying if I ever heard it.

Rule # 12. If you see another machine near you, get out of its way.

What is that rule about overtaking on the right? I'd better look that up again.

Rule # 13. No two cadets should ride together in the same machine.

That is to say without your IP's blessing or your father's, or both.

Rule # 14. Never run motor so

Two cadets should never ride alone in the same machine

that blast will blow on another machine.

More people should pay attention to this rule.

Rule # 15. Before you begin a landing slide, see that no machines are under you.

Well, slide or slip or crab or do whatever you do to get it down, but it is a good idea to look for other aircraft before landing.

Rule # 16. Hedge-hopping will not be tolerated.

How many times has this violation come out of an aircraft investigation board report?

Rule # 17. No spin on back or tail slides will be indulged in as they unnecessarily strain the machine.

You know I'll go along with that!

Rule # 18. If flying against the wind, and you wish to turn and fly with the wind, don't make a sharp turn near the ground. You might crash.

Yes, for yours or your IP's sake, or your wife's sake, or your mother's sake.

Rule # 19. Motors have been known to stop during a long glide.

Spurs are definitely not needed

If pilot wishes to use motor for landing, he should open throttle.

I think this relates to something about clearing the engine.

Rule # 20. Don't attempt to force machine onto the ground with more than flying speed. The result is bouncing and ricocheting.

I think this particular technique can be observed at any airport in the country.

Rule # 21. Aviators will not wear spurs while flying.

Scarf and goggles OK, but please no spurs.

Rule # 22. Do not use aeronautical gasoline in cars or motorcycles.

I don't think Uncle Sam would appreciate it, and besides he takes a dim view of it.

Rule # 23. You must not take off or land closer than 50 feet to the hangar.

Please, for your mechanic's sake and everyone else's.

Rule # 24. Never take a machine into the air until you are familiar with its controls and instruments.

Now you know this sounds reasonable. Something about being current also rings a bell in my mind.

Rule # 25. If an emergency occurs while flying, land as soon as you can.

Again, that's real good advice, friend.

Rule # 26. It is advisable to carry a good pair of cutting pliers in a position where both pilot and passenger can reach them in case of an accident.

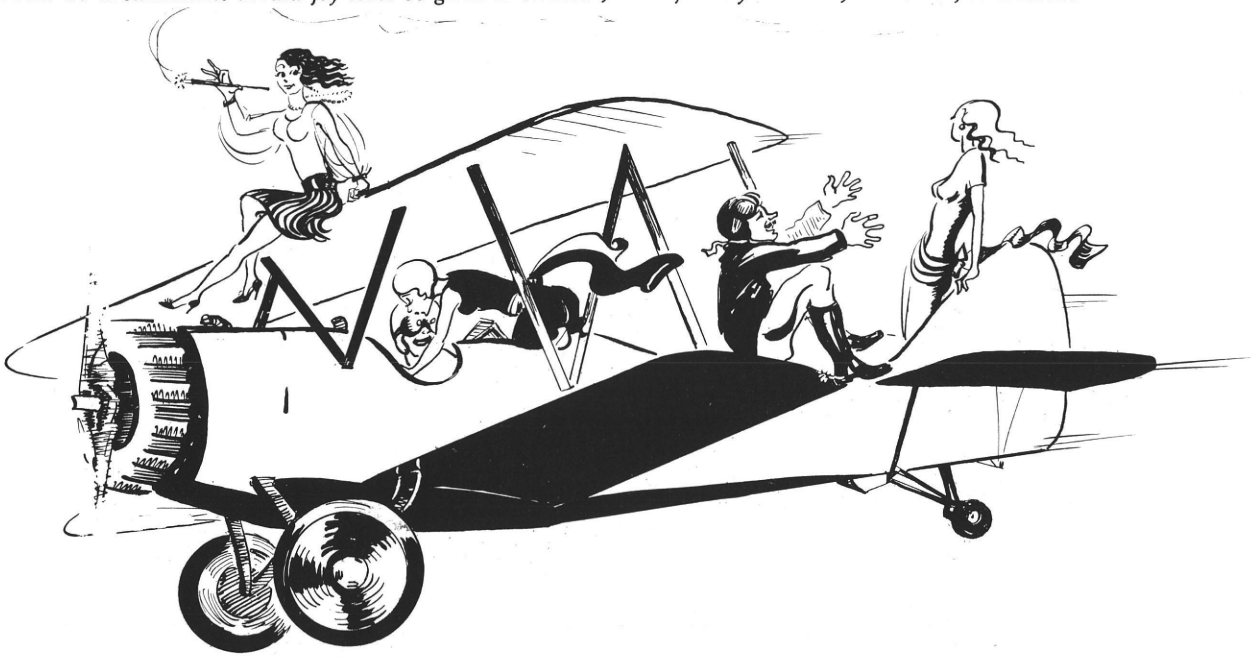
Well, let me change that a little and say something about maybe carrying survival gear regardless of the area in which you are flying.

Rule # 27. Joy rides will not be given to civilians.

Well I guess they could if they were on DA flight orders!

Enough said my esteemed friend and fellow pilot. It seems to me that those magnificent men did have some rather magnificent flying ideas. Application of them will make your flying a little more enjoyable and certainly a little safer.

Under no circumstances should joy rides be given to civilians, even if it is your sister, or mother, or someone



Adventure On A Poorly Planned Flight

Captain Richard E. Murphy

We drew straws to see who would volunteer

I HAD JUST graduated from flight school and had been instructing in fixed wing instruments for two months when this series of misadventures occurred. It started simply enough: one of the civilian instructors became sick the day before the four-day instrument cross-country. Someone had to go, so we drew straws to see who the volunteer was. As I look back now, I can see my luck first turned bad when I drew the short straw.

Bright and early the next morning, we departed Fort Rucker in our U-6 for Raleigh, N.C. The students and I had decided that we might make some additional use of the training flight by checking our records in the Pentagon. We planned to refuel at Raleigh and proceed to Davison Army Air Field at Fort Belvoir to spend the night.

The trip to Raleigh was relatively uneventful. Just before we got to Raleigh though, our UHF communications radio began to act up. After landing, I went to the local National Guard hangar to see if someone could help me, since the civilian radio man at the airport was gone. The National Guard said they would be glad to help me, but their radio man had just gone to town and they didn't know when he would return. The radios worked intermittently so I elected to proceed VFR to Davison AAF, hoping to get the radios repaired there.

We left Raleigh and proceeded towards Washington along the airways. About halfway I noted a

CPT Murphy was assigned to the Dept of Fixed Wing Training, Ft Rucker, Ala., when he wrote this article.

restricted area across our route of flight, so I called the nearest flight service station (FSS) and asked whether or not the area was active. FSS said they didn't know anything about it. I decided we had better circumnavigate it, so I dug out the sectional from the Jepp case and found the area. As I looked out I realized that the south boundary was a highway and it was directly under the Beaver. I told the student to make a sharp right turn and we flew back out of the restricted area. I kicked myself for not doing better preflight planning as it would have prevented this embarrassing and potentially dangerous episode.

Just before reaching Fort Belvoir the windshield became covered with oil, so I took the controls and called Davison Tower. After much radio difficulty, they gave me clearance to land. Upon landing we saw that a propeller seal had blown. We requested maintenance on the propeller and on the radios. I kept saying to myself "It can't get worse."

After a pleasant evening in Washington and a trip to the Pentagon the next morning we returned to Davison in the afternoon. Maintenance told us they had fixed the prop, replaced our radio receiver, and that they had also found our horizontal stabilizer was loose but had tightened the bolts. I felt pretty good that everything was repaired, including the loose stabilizer which I had not been aware of, so we decided to proceed on that afternoon to Griffiss AFB in upstate New York.

After takeoff from Davison IFR we proceeded on course, but before long lost contact with ARTCC (air route traffic control center). We made reports and received information from flight service stations along the route until eventually we lost contact with them too. This did not bother me too much

The cumulus clouds were building

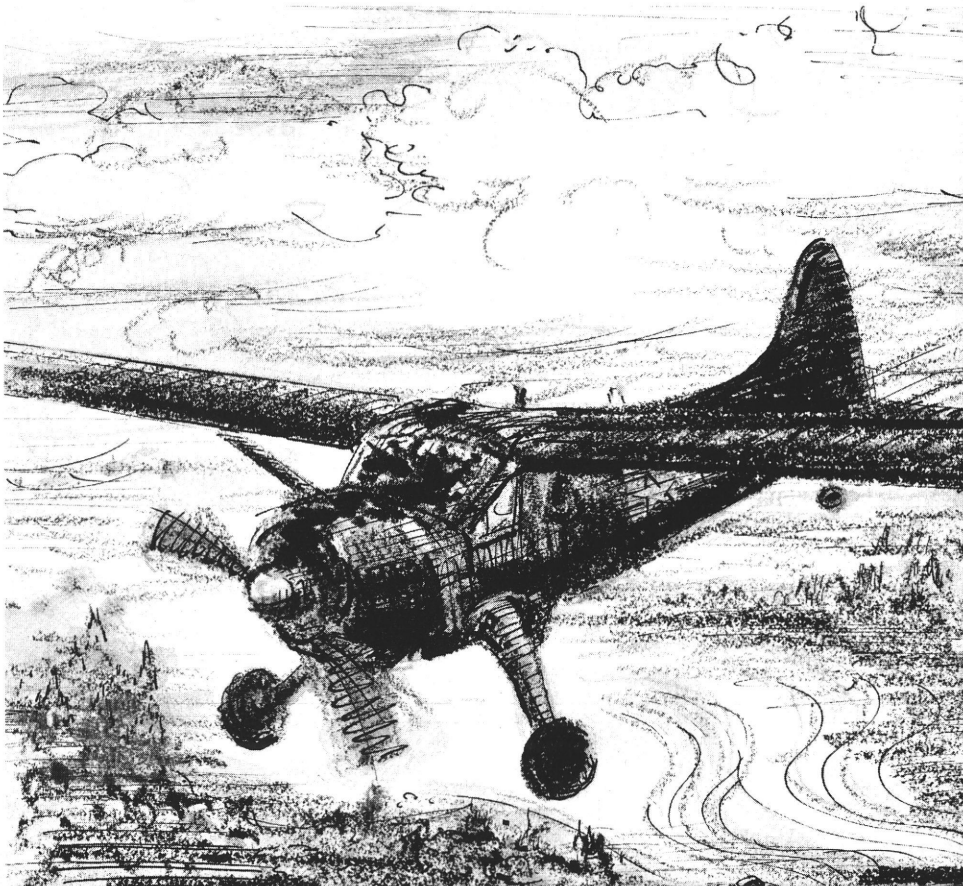
as it was a fine opportunity to emphasize proper lost communications procedures to the students. However, none of the procedures worked and I decided we had had complete radio failure.

We continued en route until 30 miles from Griffiss I received a call on "guard" from Griffiss Approach Control. They were able to hear my transmissions and we started a GCA. Just as they started to maneuver us for the GCA our chip detector warning light came on. I alerted approach control of our situation and requested they expedite our approach, but before they could answer we broke out in the clear. I cancelled IFR and proceeded directly to the airport after requesting they monitor us on radar until we reached the field. The landing was uneventful and we again requested maintenance and servicing, specifying on the request nondetergent oil.

When we came out the next morning, I told a student to check the servicing to ensure completion. A few moments later he came running back and said that maintenance had added the detergent oil by mistake since all Air Force aircraft were using it. The servicemen had not checked our request at all but had just added the oil. At first the maintenance supervisor said he did not have any nondetergent oil, but he would send someone to the nearest civilian airport, some 20 miles away, to get some. Then someone recalled that some nondetergent was stored in a back room.

After draining and changing the oil we made ready to leave. We had planned to depart VFR because maintenance advised us they could find nothing wrong with our radios. Since the weather was forecast to be no lower than 1,500 broken I decided not to cause dif-

Just before reaching Belvoir the windshield became covered with oil



Adventure on a Poorly Planned Flight

ficulty with ARTCC by attempting IFR flight with poor radios. I hoped to get to Fort Knox where we could get some maintenance done by Army radiomen, who were more familiar with our equipment.

As we started up to depart, the chip detector light popped back on. The mechanics had previously checked the sump plug and found no indication of metal particles but had been unable to isolate the cause of the short. We shut the engine down and called maintenance again. This time they found the wiring was shorting out against the cowling, causing the light to go on. By the time this was repaired it was noon, but we decided to continue to Fort Knox with a gas stop in Columbus, Ohio.

The first 10 miles after leaving Griffiss were just as the forecaster had said, about 1,500 broken, but it soon began to lower rapidly. Visibility was excellent under the clouds so we continued. The ceiling became lower and lower but it looked better out in front so we kept going. We eventually crossed the Georgetown VOR at 200 feet, at which point the ceiling began to improve. We continued southwesterly across the southern tier of New York and into Pennsylvania.

By now, it was late afternoon and the cumulus clouds were building rapidly. In fact, before I realized it an entire line of thunderstorms stretched in front of us. As we turned to fly around them they rapidly closed in on both sides. The nearest airport to our rear was 60 miles away, so we decided to try to get into the Radford, Pennsylvania Airport. We tried to contact the airport advisory service but were unable and our VOR indicated the airport was directly in the middle of a thundershower.

Things were getting a little tight now, so I decided to set down at the nearest airport regardless of what it was. The sectional showed a 1,800 foot grass strip right at Radford so we started looking and finally found it in a valley between two high hills. We made our downwind leg in the next valley, made a low turn over the town in pouring rain, and set the Beaver down just as the thundershower hit the field. We unloaded our equipment and went into town after closing our flight plan by telephone.

The weather forecast was for thundershowers and obscured ridges until the next day so we stayed in Radford. Anyone who has not spent a Thursday night in Radford, Pa., just hasn't lived. I think they even turned the street lights off at 9 o'clock, although two of the students did find some natives who stayed up until 11, or so they told me.

The next morning was not much better than the previous day, but we had VFR minimums so we proceeded to the Radford Municipal Airport where we refilled on oil. Although the mechanics had drained all the detergent oil and replaced it, we were still using a lot of oil and I was somewhat concerned. Because of the low ceilings I decided to file IFR. Even though my direct communications with ARTCC were intermittent, I knew I could contact FSS fairly easily and the weather being poor I didn't want to take any more chances.

Although it was August the temperature at 6,000 was just above freezing. Of course, we did not have a heater but even at that we were not uncomfortable. Our radios were working rather well and I thought maybe our troubles were over. But in rapid succession a student became sick, which necessitated opening all the windows, and the radios began acting up again. We continued en route by talking to FSS. After some difficulty contacting Columbus Approach Control, we arrived and landed. Leaving the sick student to supervise the servicing and to clean the cabin, the rest of us went to have lunch. We attempted to get the radio repaired at Columbus but the mechanics were unable to repair it. They did say they thought the problem was in receiver alignment, which accounted for how we could receive all frequencies up to 255.4 but none above.

To avoid questions and conflict with Columbus Tower we tuned the VOR received in to the VHF tower frequency and transmitted on UHF. Since most towers transmit UHF and VHF simultaneously it was no problem getting taxi and takeoff clearance. We departed for Fort Knox. It was now late Friday afternoon and we should have been getting back to Fort Rucker. I had hopes we might still get back late that night or early Saturday, since Saturday was my wife's birthday.

It was past dark when we reached Fort Knox. The operations officer said he would see about a civilian repairman the next morning as there were no military radiomen there. The next morning, however, he informed us that they could not authorize overtime for a radioman and that we would have to wait until Monday. I tried to convince him that three extra days TDY pay for us would more than pay for the overtime, but we were told there was nothing that could be done.

I next decided to see if we could get on to Fort Campbell where we could possibly get the radios fixed and where my brother was

A thunderstorm was over the airport

stationed. We went into the weather section to check the Campbell sequence and forecast. It was VFR, but as we stood there a new sequence report came in showing the weather was 700 overcast and 1 mile as a front moved in across Tennessee. It was forecast to remain IFR until Monday. There was now no way to get back to Fort Rucker unless we got our radios fixed.

We spent the weekend at Fort Knox. Luckily I remembered some friends who were stationed there, so it was not completely wasted.

On Monday the civilian repaired the receiver, checked it, and reinstalled it. We filed an IFR flight plan and departed. Departure Control told us to contact Center on a frequency above 255.4 and—you guessed it—nothing. We recontacted Departure Control and they advised us Center had been hearing us but, of course, our receiver was still out. The weather by now was good behind the front so I cancelled IFR and proceeded VFR to Fort Rucker.

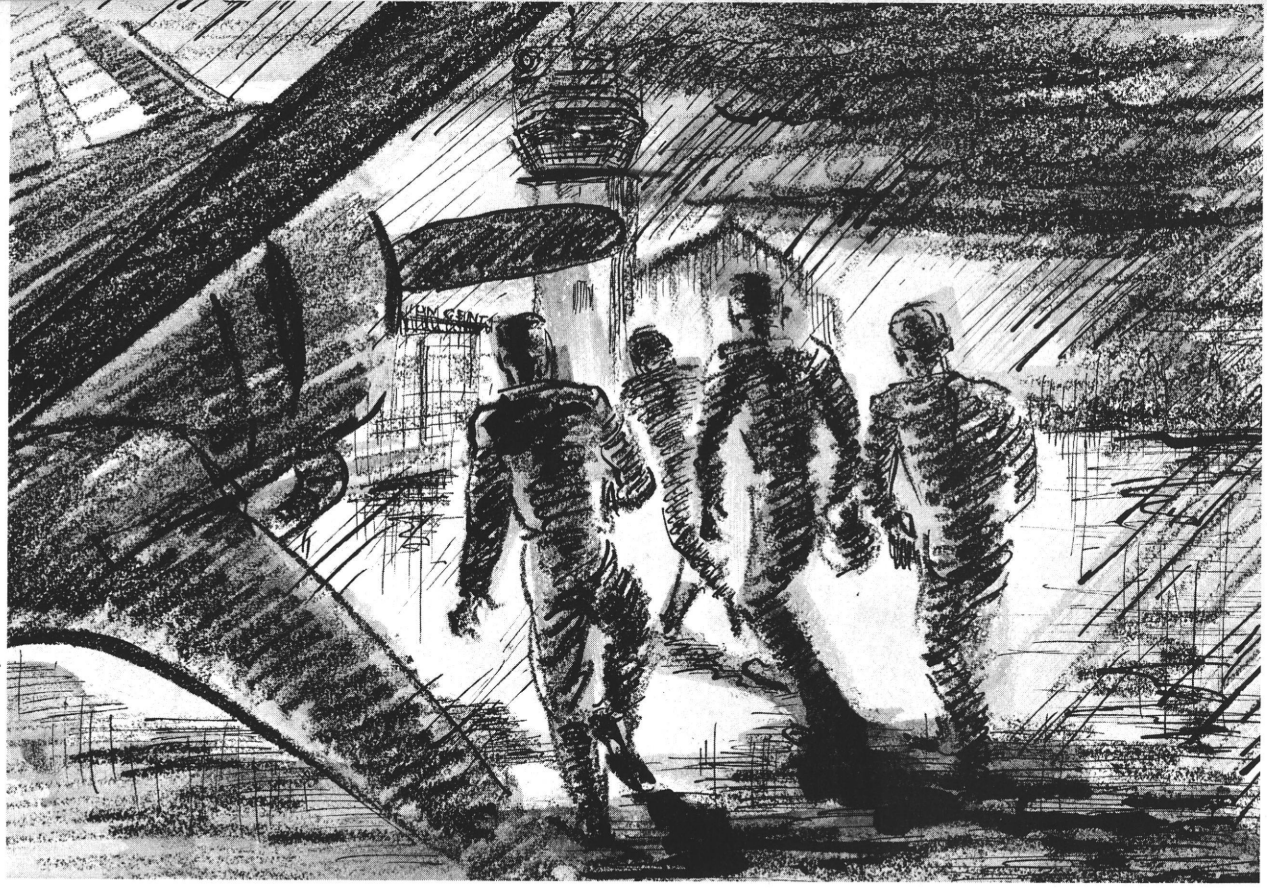
It was late afternoon as we passed Montgomery and encountered another line of thunderstorms. After flying 50 miles around the line we finally reached Fort Rucker at dusk in the middle of a rainshower. We were four young aviators who were mighty glad to be back.

Every story should have a moral, and I can think of several for this trip. At the first indication of radio trouble I should have taken action to go to the nearest Army field to get it repaired or replaced, and I should have checked to ensure it was done correctly. Many Air Force and civilian fields apparently do not have the capability to repair Army radios.

On an IFR flight it is important to have VFR sectional charts in addition to IFR en route charts. At several times during the trip I had need for them, particularly when surrounded by thunderstorms in the Pennsylvania mountains. More thorough preflight planning and more questions during the weather briefings would have saved me much sweat while in the air.

It pointed out to me the importance of closely supervising the servicing of your aircraft at strange airports to ensure that no damage is done. On another cross-country at a Naval Air Station I came out

Before I realized it a line of thunderstorms blocked my way. We turned to fly around them, but they closed in on both sides.



It was dark and we were doused by a heavy rainshower, but it was good to be back home at Fort Rucker

of operations just in time to stop a sailor from walking out on the wing of a Beaver to fill the tip tanks.

Another error I feel I committed was in not checking my weather for the next several days. Had I been more aware of the front and its associated low ceilings, I might have decided to proceed directly from Griffiss AFB to Fort Rucker VFR to avoid spending the extra days at Fort Knox. As it was, all I checked was the weather for each leg, and the bad cold front weather was there before I knew it was coming. It taught me a lesson.

As a training flight, however, the students and I learned more than we ever could in three trips without difficulties. But I must admit that towards the end we half expected the entire aircraft to fall apart under us, since it was the only thing that had not happened.

Motive-Pay Fly Rules Changed

THE FOUR HOUR monthly aerial flight requirement for incentive pay may be satisfied by applying any flight time accumulated during the five calendar months immediately preceding which have not been used to qualify for incentive pay.

This change is designed to reduce the requirement for support aircraft that are justified and used solely for the purpose of qualifying for flight pay.

While the new policy applies to all Army personnel on flight status it is intended to be used primarily by the following categories of personnel:

- Aviators assigned to remote locations.
- Those on flight status who are attending civilian educational institutions or nonflying service school courses of less than five months length.

Army personnel on flight status who are assigned to duties requiring the individuals to be engaged in nonflying tasks where monthly maintenance of flying proficiency is not always feasible.

For further information, see AR 95-32 and AR 37-104.

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ARMY NEWS FEATURES

FAMILY AFFAIR

RECENTLY in the Rung Sat Special Zone a CH-47 Chinook helicopter of the 147th Assault Support Helicopter Company was forced down by intense hostile ground fire.

It had been lifting an ARVN ranger battalion into action. When it went down two ARVN platoons threw up a perimeter around it to provide security through the night against mounting Viet Cong forces.

The next day a maintenance team determined that the ship was too heavily damaged to be repaired in place.

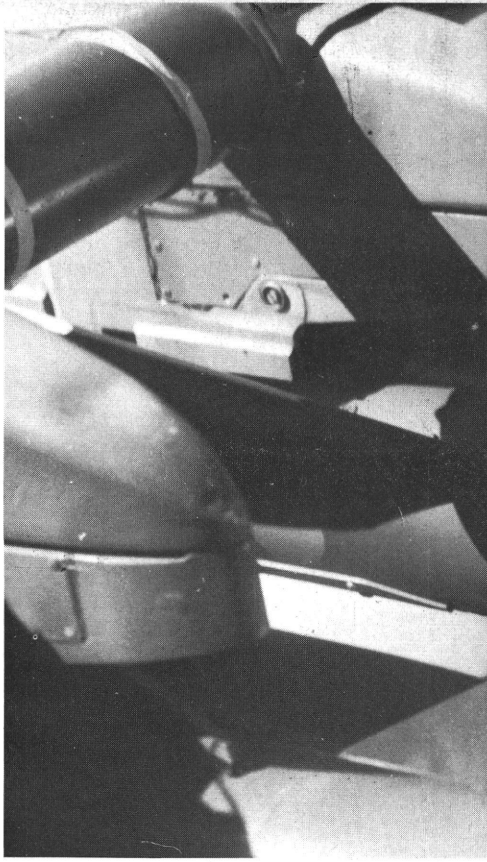
A CH-54 Flying Crane was requested from the 1st Cavalry Division to airlift it out, but one would not be available for several days. The ARVN ground commander was confident that the VC would destroy the downed Chinook by mortar, recoilless rifle, or other attack if it remained for that period of time.

The maintenance team decided to attempt evacuation by another CH-47. Only once before had this feat been successfully accomplished, and that was under peaceful conditions back in the States. Now the almost certain destruction of the disabled helicopter by VC made the "Chinook-by-Chinook" evacuation worth the attempt.

In its present state the downed CH-47 was much too heavy to be lifted by another Chinook. About 9,000 pounds would have to be stripped from it. Many major components such as rotors, engines, transmissions, armor plates, ramps, armament, and doors, would have to be removed, and in such a fashion as to maintain reasonable symmetry of weight distribution for proper balance.

Beginning at dawn the next day, the team went to work. The stripped CH-47 was ready for evacuation late that afternoon. Stabilized by a drag chute, the Chinook was lifted into the air by a sister ship and flown to maintenance facilities at Phu Loi.

HELICOPTER VS TANK



In any future global conflict just how much emphasis will be placed on armored conflict? "In a nuclear war, should one break out, tanks will occupy the dominant position on the battlefields." This statement by Soviet Marshal Rotmistrov, published in Izvestia on October 20, 1962, is an authoritative stand by a Soviet military leader on the role of tanks in Russian war plans.

Captain Willard E. Bailey

TANK DESTROYER forces have been common in most armies of the world since the introduction of massed armor in World War II. Many of these countries still place much emphasis on tank destroyer type units, equipping these units with the best antitank weapons the country can produce. After World War II, the United States Army deactivated its tank destroyer units basing its tactics on the theory that the best antitank defense is another tank.

Let's consider two cardinal points of an antitank defense: If infantry is going to be employed in defensive action it must be given protection against enemy tanks; and massed armor, employed in offensive operations, also requires protection against enemy tanks.

What weapons system is available to the ground commander which can help fill this role as a tank destroyer?

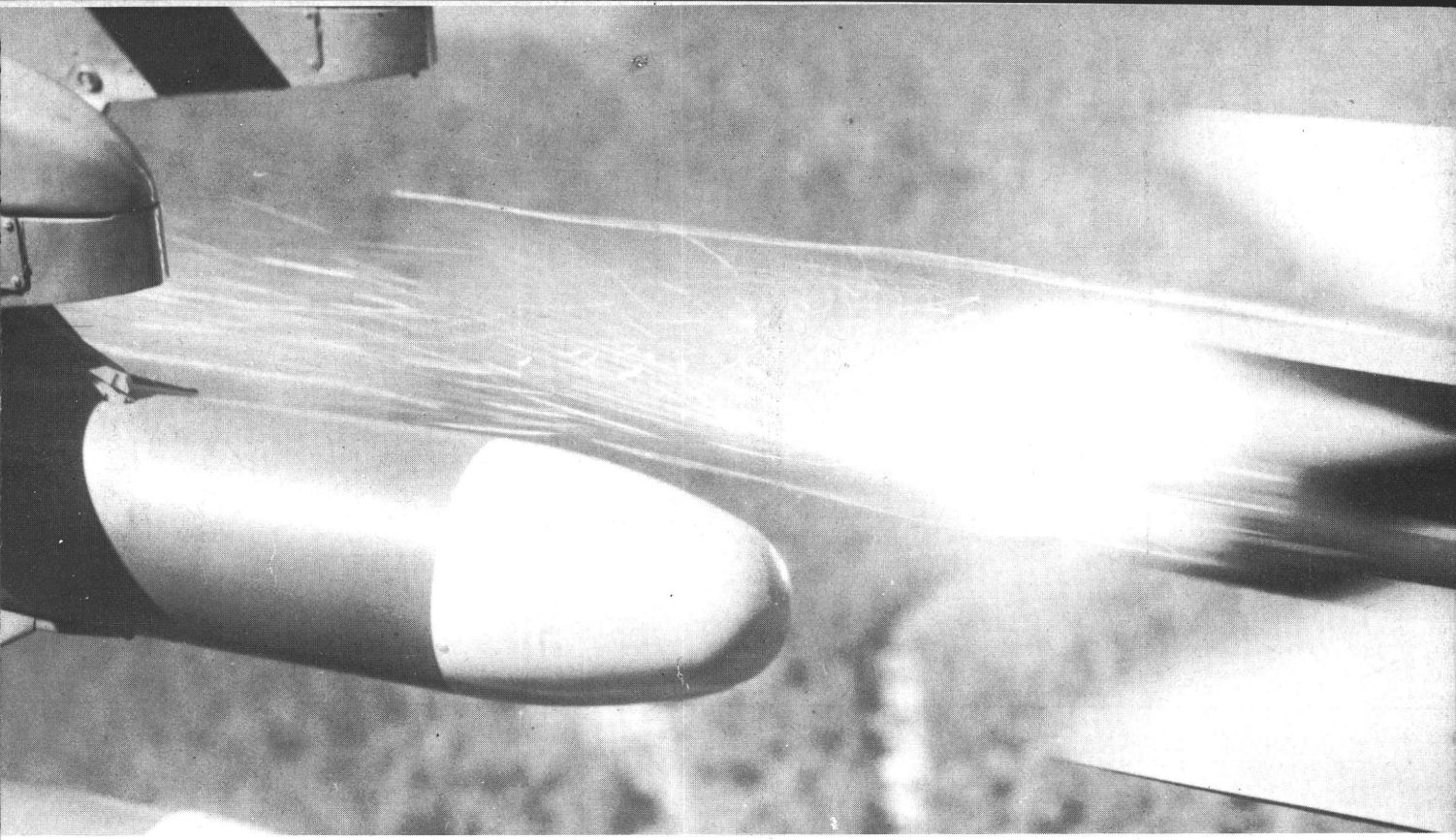
The M-22 subsystem is the only point fire weapons system now available to Army aviation. It is capable of defeating any known armor in the world. Located within a 12-division field army 100 of these systems are assigned as far as division level, excluding 12 authorized the airmobile division.

Mounted on the UH-1B helicopter the M-22 can be fired from the static, hovering or running flight attitudes. It is capable of engaging targets at a range of 3,500 meters. Minimum engagement range should be 500 meters with the hit probability actually increasing as the range increases.

Adoption of the M-58 gyro stabilized sight enables the gunner to easily engage targets at 3,500 meters and also allows some evasive maneuvers by the pilot. Not only does the sight aid the gunner in tracking the missile to the target but it can also be used to acquire targets at even greater ranges.

Presently the Army Aviation School has the capacity to train 16 gunners per month. The M-22 qualification course lasts three weeks—two weeks of classroom instruction and one week firing on the range.

During range firing the student fires 10 missiles and must hit 6 targets to qualify. Because each of the 10 missile shots is progressively harder, giving the student as many different flight modes and ranges as possible, the student should be able to better his percentage in subsequent firings. With a minimum of training on the



simulators after graduation, the gunner can easily maintain his proficiency with the system.

Now that we have a capable system and a trained gunner, what kind of results can we expect in helicopter versus tank operations?

In a recent test the helicopter was used in support of defensive and offensive operations. During the defensive phase the aggressor armor was on the offensive and was easily acquired by the helicopter employing nap-of-the-earth techniques to acquire and engage the tanks.

The helicopter was not equipped with the M-58 sight and engagement was made at 1,000 meters or less. As long as the aggressor tanks were in the attacking role their acquisition of the helicopter on its initial pass was not timely enough to allow them to lay their guns on it. It should be noted that the tanks were not "buttoned up" during the tests.

During the offensive phase the aggressor tanks occupied defensive positions, using cover and concealment afforded by the wooded terrain. Acquisition of the tanks was much more difficult for the helicopter. During the entire test the tanks were only able to lay their guns on the helicopter 30 percent of the time the helicopter was in the immediate area. Out of this figure only 10 percent would have resulted in aircraft hits and these were all at ranges of 1,000 meters or less.

The test brought about some of the following conclusions:

- The helicopter was successful in acquiring tanks in the open.
- Current armor attack formations presented multiple targets to the helicopter on its passes and limited effective return fire.
- Tanks generally were unable to react in time to counter during the initial pass of the helicopter.
- Natural cover employed by tanks in defense thwarted their acquisition by the helicopter.

Even though the test was somewhat limited in scope, it shows that the helicopter can be an important addition to any tank destroyer force.

Although there are many methods of employing the M-22 subsystem in the tank destroyer role, the following would be some of the basic considerations and tactics.

Armed helicopters should never be employed singly. It is envisioned that a tank destroyer team would not only include the M-22 subsystem but also escort helicopters mounting the M-16/XM-21 to suppress ground fires encountered during the operation.

Under certain circumstances the M-16/XM-21 armed aircraft as part of the tank destroyer force could assist against the armored targets by firing their rockets to force the tanks to "button up," making acquisition of the helicopters that much more difficult for the tank crew. Ideally, the M-22 subsystem should be employed at its maximum range. If the helicopter can acquire and engage at 3,500 meters it thereby improves its survivability by keeping out of

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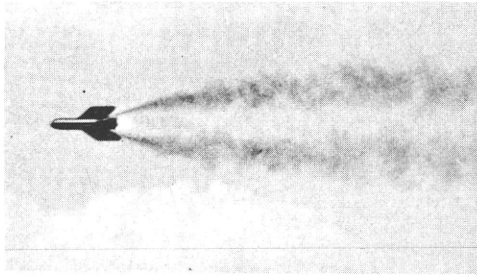
Helicopter vs Tank

the effective range of the tanks' antiaircraft capabilities.

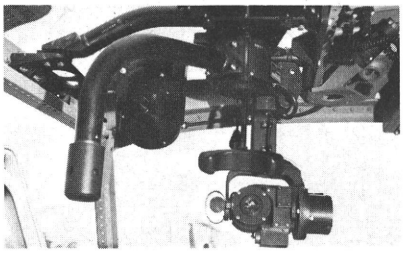
The ideal target for the helicopters would be tanks moving in the open with the helicopters attacking them from the rear or flanks. While tanks are moving they can easily be acquired either by dust or diesel fumes (exhaust) and, because of the noise, the tanks' crew would have a difficult time hearing approaching helicopters. By using nap-of-the-earth techniques helicopters have the elements of surprise and speed and can effectively engage any type armor formation.

In a nuclear warfare situation the use of helicopter tank destroyer teams would greatly enhance the ground commander's security and reconnaissance capability. For example, they could exploit an area neutralized by nuclear weapons and stop any exploitation of the area by enemy armor units.

Though enemy armor tactics may differ under different tactical situations, the main requirement for tank defense is to protect the infantry. The use of the helicopter in an antitank role, with its versatility and its ability to live with the frontline troops, greatly expands the ground units' antitank defense.



Above: The M-22 on the Huey.
Below: The sight that is being used by the aviator (lower right) to put the missile in flight (right).
Lower left: The missile is attached to the launcher.



Playboys and the 'Lightning Bug'

Major William W. Fraker

PLAYBOYS AND nightlife seem to go together well, but playboys, nightlife, and the Lightning Bug make for an unusual combination. This is the story of such a combination.

The Playboys were one of the armed helicopter platoons of the 197th Aviation Company, 145th Aviation Battalion, in South Vietnam. The nightlife is a part of the program of COMUSMACV for interdiction of Viet Cong supply routes within South Vietnam. The "Lightning Bug" is a searchlight incorporating seven C-123 aircraft landing lights rigged up through a joint effort of the 197th Aviation Company and the Army Concept Team in Vietnam.

Like playboys the world over who seek out cities with the most to offer in the way of wine, women, and entertainment, the Playboys in this story also seek entertainment—a brand consisting of destroying Viet Cong sampans carrying supplies and personnel into the ARVN III Corps area. The area selected was the vast expanse of rice paddies, pineapple duras, and sugar cane fields west of Duc Hoa.

Headquarters, 25th Vietnamese Infantry Division, "Old Good Nature Control," was the control center. These Playboys took off from Tan Son Nhut Air Base at 2200 hours, 9 August 1965, with the necessary equipment to ensure a safe and enjoyable evening: A "Hog" with 48 rockets, a "Frog" with 24 rockets and the M-5 40 millimeter grenade launcher, a "Dog" (old gunship) with four 7.62 caliber machineguns and 14 rockets, and the "Lightning Bug" mounting the searchlight, four 7.62 caliber machineguns, and 14 rockets.

The Playboys proceeded to the Vaico Oriental River near the village of Luong Hoa, where the brilliant beam of Lightning Bug disclosed ten lovely sampans in a small canal. The Playboys promptly sank three and damaged four, obtaining two prominent secondary explosions. The remaining three sampans succeeded in hiding under the overhanging trees. Later intelligence reports stated that a Viet Cong battalion had just off-loaded the sampans and occupied positions for an attack on Luong Hoa. Ninety Viet Cong were supposedly killed. Result: No attack on Luong Hoa.

Satisfied that their welcome had worn thin, the Playboys crossed the river to another of the countless canals. Lightning Bug showed them three small sampans with four blinking, bewildered occupants who soon disassociated themselves from this blinding scene. One sampan was sunk, two badly damaged, and one VCKBH (Viet Cong Killed by Helicopter).

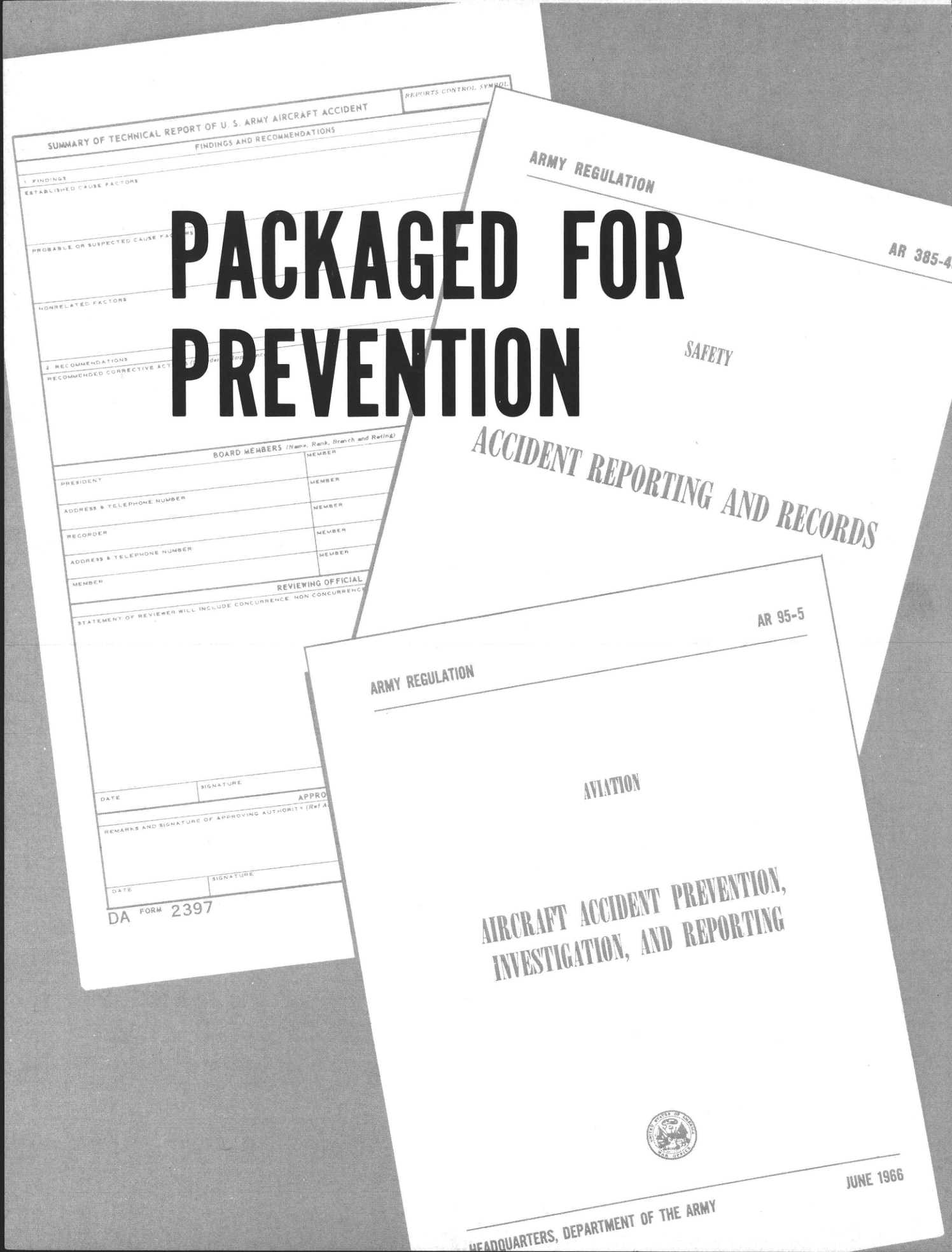
Feeling the need for liquid refreshment, the Playboys returned to Tan Son Nhut and replenished themselves with coffee, JP-4, and calling cards. At 0100 hours, 10 August 1965, they took off for the Vaico Occidental River and found the main attraction of the evening: fifteen sampans, one 45 feet long, cruising merrily downriver! After dodging a few bullets, some not quite so successfully, the Playboys spent 30 delightful minutes sinking all 15 sampans and thoroughly enraging their occupants along with the inhabitants of two decidedly unfriendly villages adjacent to the river boat show.

Having dire need for more calling cards and a few patches for minor holes in their helicopters, the Playboys hastened back to Tan Son Nhut, hoping they would not miss the inevitable encore at the river boat show. Hurriedly checking limbs and appendages and replacing two perforated helicopters, they joyously sped back to catch the water ballet then in progress starring several score soaked Viet Cong. Upon arrival, the last act was just coming onstage. This happened to be a lonesome looking sampan some 35 feet long, evidently searching for the recently commissioned Viet Cong submarine fleet. Twelve rockets later, he joined his mates among the happiest catfish in Vietnam.

Quite an evening for playboys anywhere, but exceptionally so for the Playboys of Vietnam. This is only one of many successful Lightning Bug missions that are the result of the cooperation, ingenuity, and teamwork of everyone involved in the program of denying the Viet Cong freedom of night operations. It is also a small but important part of our efforts that are showing more and more erosive effect on the morale and combat efficiency of the Viet Cong. The Playboys and Army aviation score again!

MAJ Fraker is branch chief, Special Projects and Standardization Branch, Aviation Armament Div, Dept of Tactics, Ft Rucker, Ala.

PACKAGED FOR PREVENTION



crash sense

the following twenty-eight pages prepared by the United States Army Board for Aviation Accident Research

PRIOR TO THE BEGINNING of this month, commanders, aviation safety officers, and aircraft accident investigators had to search through many publications to find the information necessary for accident prevention, investigation, and reporting. Most of this information has now been consolidated in AR 95-5 and AR 385-40. Together with the new DA Form 2397 series, these publications make a package designed to improve, simplify, and standardize the Army aviation safety program.

AR 95-5

This new regulation, which became effective 1 January 1967, supercedes DA Pamphlets 95-5 and 95-9. In addition, it contains instructions for completing the DA Form 2397 series and includes a crash plan guide (appendix I), a sample flight hazard report (appendix II), a sample crash facts message (appendix V), and an aviation safety planning guide (appendix VI).

Part one of the new AR 95-5 is devoted to aircraft accident prevention. In addition to chapter 1 which describes the purpose, scope, and organization required for Army aircraft accident prevention, other chapters are on the concept, command responsibility, staff responsibility, and the planning and organization necessary for an effective aviation unit safety program.

Part two of the new regulation pertains to aircraft accident investigation and contains chapters on investigation responsibility, collateral investigations, preaccident organization and planning, investigative procedures, techniques of investigation, and medical factors.

Part three is titled "Aircraft Accident Reporting." It contains chapters on reporting procedures, instructions for completing the DA Form 2397 series, instructions for completion of crash facts messages, and the format and contents of accident folders.

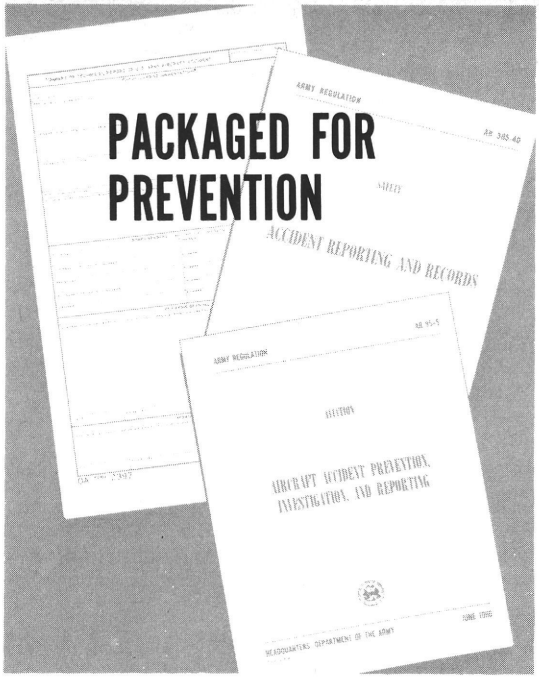
AR 385-40

The new AR 385-40 was effective 1 July 1966. However, the new DA Form 2397 series had not been published by that date. Because of this, the effective date of section IV of this regulation was delayed until 1 January 1967. Some of the changes affecting Army aircraft accident and mishap reporting are:

DEFINITIONS

Paragraph 7a (1) *Accident.* "Damage to one or more Army aircraft in the Army inventory which occurs between the time the engine or engines starting procedures is (are) initiated with the intent to fly, until the time the aircraft comes to rest with all engines and propellers or rotors stopped, upon completion of flight, regardless of responsibility. (Intent to hover a helicopter under its own power from its parked position will be considered in flight.) If flight was not intended, although engines, rotors, etc., were running, this occurrence will be placed in one of the other classifications of accidents in this paragraph.

"Note: 1. When two or more Army aircraft are involved in an accident, damage to all aircraft will



be used to classify the accident as major or minor. When Army and non-Army aircraft are involved in an accident, the Army damage only will be used to classify the accident as major or minor.

"2. Aircraft damage amounting to $100 or more, but not extensive enough to be classified as a minor accident, will be reported as an 'Other' accident." (For definitions of "Other" accidents, see paragraph 7f of new AR 385-40.) This note does not relieve the requirement to submit an aircraft "incident" TWX to addressees listed in paragraph 23c of this regulation.

The new regulation describes a major accident by: "An aircraft accident is classified major when the aircraft is destroyed; or damage sustained is equal to or in excess of the criteria (manhours) cited in table I; or damage to a major component is so extensive as to require removal and replacement with a new component. Examples of major components are—

"1. Main rotor heads.

"2. Transmissions.

"3. Tail booms and empennages.

"4. Wings (exclusive of flaps or ailerons).

"5. Wing center sections.

"6. Fuselages or major sections (exclusive of rudders or elevators).

"7. Vertical and horizontal stabilizers.

"8. Undercarriage upper cylinder assemblies and fuselage attaching points only (exclusive of wheels, brakes, struts, tires, outrigger or protection gear and tail gear).

"Note: Engines will not be considered major components."

Table I of the new regulation contains the manhour classifications for determining major damage. These are the same as those in the old regulation, except that OH-6 and TH-55 aircraft have been added to the class A listing (150 manhours); U-10 and T-42 aircraft have been added to the class B listing (400 manhours); and CH-54 and CV-7 aircraft have been added to the class C listing (500 manhours).

Added to the list of definitions in the new regulation are:

"*Abandoned aircraft.* An aircraft mishap which occurred in a remote area in which recovery is impossible or impracticable. (Examples: Loss at sea, aircraft in area controlled by unfriendly forces, etc.) This mishap will be reported as a major accident."

The new regulation contains the following instructions for accounting for aircraft accidents and computing accident rates:

"If only one Army aircraft is involved in an accident, the accident will be included in the rate computation of the organization which completes the Army Aircraft Inventory, Status, and Flying Time Report (DA Form 1352, see AR 710-12).

"If more than one Army aircraft is involved and the flying hours are reported by different organizations, the accident will be included in the rate computation of the organization deemed most responsible for the accident. . . ."

Paragraph 22 of the new regulation contains these new provisions for investigation of aircraft accidents:

"After notification of an aircraft accident as outlined in paragraph 14, the aircraft operator's commander or supervisor will be responsible for initiating action for the investigation and reporting of the accident. If for reasons of remoteness, or lack of qualified personnel, a commander cannot adequately conduct such an investigation, he will request

these regulations and the new DA Form 2397 series have been designed to extract accurate cause factors and prevention information from all Army aircraft mishaps . . .

assistance from the next higher headquarters.

"When two or more Army aircraft are involved in the same accident and the operators are from different organizations, the organization deemed responsible will have investigative responsibility. Only one aircraft accident investigation report will be submitted.

"Investigation of aircraft accidents which occur during ferry flights is the responsibility of the organization to which the aircraft operator is assigned at the time of the accident."

Under the new regulation (paragraph 23), supplemental information for crash facts messages, referencing the original message, including the date of the event, aircraft type and serial number, and containing all additional information is required within five working days of the original message.

Item 3 of the message format for crash facts messages in the new regulation requires an estimated dollar amount of damage *only* for incidents. Under the old regulation, dollar damages were required for minor accidents and incidents.

Items 5 and 6 of the message format for crash facts messages in the new regulation only require data on all crewmembers (other than the operator) and passengers for major and minor accidents. Previously, this information was also required for incidents.

Under item 9 of the crash facts message format in the new regulation is this note: "If the word 'suspected' is used in the crash facts message, the supplemental message will contain clarified information concerning failure or deficiency. Where no failure or deficiency is found, a negative reply will be required."

The new regulation requires that the president and other members of aircraft accident investigation boards will be selected from organizations other than the aviation company or detachment in which the accident occurred. This does not preclude assigning one member of the board from the unit in which the accident happened. To ensure a thorough and impartial investigation, the regulation requires that no member of the board will have a personal interest in the accident.

An important change in reporting requirements is contained in paragraph 24b of the new regulation which states: "Original technical reports of major and minor aircraft accidents (DA Form 2397 series) occurring within the continental United States will be dispatched through channels to arrive at USABAAR within 30 working days after the date of the accident. Original reports of major and minor accidents occurring outside the continental United States will be dispatched through channels to arrive at USABAAR within 40 working days after the date of the accident. . . . Commanders designated as the approving authority for Army aircraft accident reports or those at appropriate indorsing headquarters will notify USABAAR when they are unable to comply with these specified arrival dates. This notification will include an adjusted arrival date for the report."

These regulations and the new DA Form 2397 series have been designed to extract accurate cause factor and prevention information from all Army aircraft mishaps. Information from these sources is vital to the Army aircraft accident prevention program. The success of this system depends upon the full cooperation of all who investigate and report aircraft mishaps. A thorough study of the new regulations and reporting forms should be made a part of the preaccident planning for all Army aviation activities.

VERTIGO

While flying under the hood several weeks prior to the accident, the pilot developed vertigo and held the aircraft in an unusual attitude until his instructor corrected him

A deep low pressure center to the north dominated the weather picture on a day in late winter. A series of troughs circulated around the south side of the low, under strong westerly to northwesterly winds. Broken to overcast skies were the rule, with numerous snowshowers throughout the area. As would be expected, the most intense showers were generally found along the northern and western slopes of the hills.

Visibility was generally good, 5-10 miles, outside the snowshowers. In the showers, however, visibility fell to less than one-half mile at many reporting stations. Inflight visibility was even poorer according to pilot reports. The freezing level was near 1,500 feet and the air was very moist above 2,500 feet. The sounding was fairly unstable all the way up to 20,000 feet and supported the forecast for heavy showers and thunderstorms.

Radar reports were given almost hourly throughout the day. At 1245, an area of echoes was "painted" over the area and to the north. An hour later, these had spread to the west and drifted south under the prevailing northwesterly winds aloft.

Four helicopters were assigned to support a field exercise. Two of these were supporting a transportation company.

OIC: "I released the CH-34 crews to eat lunch at about 1130. One pilot had asked if they could eat together at the snack bar, since it was close to the pad and we could get them if they were needed. I agreed and told him that he would be in charge of the helipad when we left to eat.

"The CH-34 pilots had returned by 1240 and a large snowstorm was approaching. I told one pilot we were leaving for lunch. I told him to keep the medical evacuation ship ready and placed him in charge. I placed another officer in charge of the FCC van and the rest of us went to eat.

"Just as we were beginning to eat, we heard a CH-34 pass overhead. This was at 1250. I felt that it was probably still helicopter VFR at the time, but knew that a snowstorm was rapidly approaching. It had started to snow as we entered the club. I felt that they must have taken an actual medical evacuation. However, the weather situation worried me, so I asked a lieutenant to call the FCC van and find out what had happened. He returned and said they had gone on a simulated medical evacuation. We finished our lunch hurriedly and returned to the van. There, I determined that the CH-34 had been contacted and the pilot informed of the weather that existed at the helipad, which was very

poor in heavy snowshowers. The controller instructed them to set down and wait for our call, or until we came after them, before returning. The weather was too bad to fly, but we did attempt periodic radio contact until 1350. We got no responses.

"Conditions improved rapidly and at 1350 I instructed an OH-13 pilot to go up for a weather check, and to attempt radio contact with the CH-34. He reported 400-500 feet and five miles visibility. He could not establish radio contact with the CH-34. I was still not extremely worried, since we reasoned that they had set down as instructed. . . .

"At 1415, the weather had improved enough to have the OH-13 pilot recon the flight route and look for the CH-34. At the same time, I dispatched another CH-34 to search for the missing aircraft. I then sent an OH-13 up to remain in the pattern for radio relay. . . .

"At 1515, we got the sighting report from the OH-13 pilot. He reported that the CH-34 had crashed and it looked bad. . . ."

Pilot witness: "At about 1330, I was flying a passenger when a snowstorm blew across our route, forcing me to continue in a high hover, at approximately 10 knots. Visibility deteriorated the further I continued up the road, as the rising ground was gradually bringing me into the cloud base.

"When the visibility dropped to 200 yards I told my passenger we would have to land until the snowstorm passed. At this point I saw a CH-34 on the ground ahead and landed some 50 yards south of it. This was at 1340.

"After 10 minutes on the ground, I saw no great improvement in the weather and advised my passenger to continue by car. He left the aircraft and walked down to the main road.

"At about 1440, I heard the CH-34 speed up and, looking through my side window, saw it take off in a northerly direction. As the visibility had improved somewhat, I decided to follow suit and started up my engine. By the time I was at a hover, I imagine the CH-34 had cleared the immediate area as I saw nothing further of it.

"After takeoff, I managed to clear to the north, maintaining visual ground contact at all times, but was unable to go to my destination because of the cloud which was down to ground level in that area. I skirted the storm to the west and returned to my base. . . ."

Farmer witness at crash site: "At about 1400 hours, I was in my house when I heard the loud sound of a motor. It sounded as though a helicopter was ready to land. At that time, there was a severe storm and it was foggy. I was on my way outside when my helper approached and said that a helicopter had crashed and was on fire. In the meantime, the sound of the motor had stopped. I went outside, saw that the helicopter had crashed and was on fire, then returned and called the police. . . .

"Then I went to the scene of the crash. . . . The helicopter was burning full blast and we could not do anything. . . ."

The aircraft was a total loss and the three crewmembers were killed in the crash.

Investigation board analysis: "Upon examining the crash site, it was obvious that the CH-34 struck the ground at high speed, in an extreme nose low attitude. The depth of the strike marks and disintegration of the aircraft indicated that the force imparted was over 200 g's.

"The events leading to the accident were examined in detail to determine what prompted the pilots to take off and continue to fly in such poor visibility on a simulated medical evacuation. Although testimony indicated there may have been some doubt that there were to be no more simulated missions once the exercise started, at the time this mission was received, the pilots were told several times that this particular mission was simulated. . . .

"The area had been subjected to frequent snowshowers throughout the day and visibility had varied from one-half mile to zero in the snowshowers. . . . Neither the pilot nor the copilot were instrument rated. They did not have extensive instrument (hood) training. The pilot was assigned the primary duty of property book officer in his unit. According to his flight records, he had not flown extensively in the previous weeks. He had been counseled the morning of the crash by the commander concerning the responsiveness of his crews for a mission on a previous day. At that time, the aircraft were not ready for flight at the time directed. No undue friction was present. However, there may have been a tendency to do more than required to offset this situation.

"Another influencing factor on the crew's decision to go may have been a UH-1B flight through snowshowers into the area the previous day. It had landed repeatedly en route to wait out passing snowshowers. The delayed arrival created a feeling of apprehension among the helicopter crews, all of whom saw the UH-1B finally come in during a light snowshower. The pilot and copilot of the CH-34 knew of that flight and were aware that the

UH-1B crew had 'poked on through,' but it is not believed that they were aware of the fact that both UH-1B pilots were instrument qualified instructor pilots and experienced senior Army Aviators.

"The CH-34 pilot had volunteered for the field exercise duty to get away from his desk and get some flying time. It is probable that he would have taken every opportunity to fly, even in less than ideal weather conditions. One indication of possible impulsiveness on his part was given in a witness statement to the board by another pilot. He stated that on one flight, the CH-34 pilot contour flew for 45 minutes while giving a new acquaintance an orientation ride.

"Although the weather in the area had been quite variable that morning and the previous day, there was no evidence that the pilot or copilot received a personal weather briefing at any time on the day of the accident. It is possible, however, that one of them had read the area forecast and existing weather posted in the FCC van.

"Possible severe turbulence had been forecast for the area and at least one pilot had encountered moderate turbulence in an OH-13. Therefore, the board closely examined the wreckage for signs of inflight deformation from turbulence. Extensive examination of the main rotor blades, tail cone, and pylon failed to reveal any deformation that was not attributed to ground impact. . . . There was no indication of pre-impact material failure. . . . Power was being developed by the engine at impact in the opinion of the maintenance representative. An examination of the main drive shaft showed that the drive lugs of the upper coupling had sheared and the drive shaft showed torsion type stress was being applied at impact. Witness statements also

supported the conclusion that the engine was running at the time of the crash. . . . It is the board's opinion that the aircraft was intact and controllable prior to ground contact. . . .

"It is the board's opinion that the aviation element participating in the exercise was well organized, tightly run, and thoroughly supervised. Had the commander been present at the helipad when the simulated medical evacuation mission was received, in all probability the mission would have been refused because of the weather. It is considered impractical to assess the commander with the responsibility of personally monitoring each takeoff. Some reliance must be placed on the pilot's ability to determine the suitability of the weather.

"The pilot and copilot coped with the weather up to the time they landed in a field and were seen by the pilot of another helicopter. The accident was an aftermath of their second decision — to take off again. . . .

"The pilot and copilot had been in the area long enough to become well indoctrinated to local weather conditions. . . . Testimony from all witnesses indicated it was snowing in the area of the accident, with ridges obscured and low stratus further reducing flight visibility. . . .

"The board concluded that as the helicopter came upon a tree and village, the crew decided to turn back. The pilot made a left pedal turn which would have required application of collective pitch and aft cyclic to keep from settling as the aircraft turned downwind. The increase in ground speed with a 25 knot tail wind would probably have caused the pilot to apply more aft cyclic in his attempt to slow the helicopter. Rising terrain may have caused him to add collective. At this point, knowing the ridge and tree line were ahead, the pilot could have decided to flare the aircraft, turn, and land into the wind. If he had enough collective applied, his flare would have caused him to climb, where he entered a low stratus cloud in the blowing snow. He would then have been forced with the dilemma of either attempting to descend out of the cloud straight ahead toward the ridge, or making a 180° turn on instruments. Witness statements indicated he chose the latter course.

"Realizing that neither pilot had any real instrument experience, and that the pilot had previously gotten vertigo flying hood straight and level, the board attempted to duplicate the flight to determine control inputs and the experience level required to complete the maneuver. With an experienced instrument rated pilot at the controls, a CH-34 was flown into a two needle width turn at 40 knots and 100 feet. The steep turn was chosen because it was felt that the pilots would have experienced an overpowering urgency to turn the aircraft and regain ground contact. It was found that a large displacement above the artificial horizon bar was required to maintain altitude. At the 90° point, as airspeed began to drop off slightly, a definite, but not excessive, application of forward cyclic was made to increase airspeed. Within 3-5 seconds, the helicopter had entered a high rate of descent and the nose was dropping rapidly. Immediate action was necessary to recover 25 feet above the ground. The same turn was made four times with identical results. Each time, the rate of descent was 2,000 fpm as the recovery was made.

"Considering instrument lag and the level of the pilots' instrument proficiency, it is the board's opinion that had the pilot attempted a similar turn at low altitude in the cloud, by the time he broke out of the cloud, it would have been impossible for him to recover before impact."

Flight surgeon: "The pilot definitely failed to anticipate hazards related to the weather in the area on the day of the accident. He took off in marginal weather, landed because of this weather, and then took off into weather which was less than VFR minimums. Although not instrument rated, he encountered weather conditions which, as a rated aviator, should have prevented him from taking unnecessary chances. In this case, this factor should be considered as having a casual role in the accident. . . .

"Overconfidence—the officers and warrant officers interviewed by this investigator, with one exception, were of the opinion that the pilot was overconfident. Several stated that in their opinion he acted as if he 'knew it all' and was unreceptive to any criticism, even though it was meant to be constructive. . . .

"There seems to be no doubt that the pilot became disoriented after entering the low ceiling of clouds and losing all visual reference to the ground. The aircraft was seen to enter the clouds, reappear 10-20 seconds later in a nose down attitude, and plunge into the ground. The supposition that this pilot developed vertigo is further supported by the fact that he was not instrument rated. While flying under the hood several weeks prior to the accident, he became disoriented and held the aircraft in an unusual attitude until his instructor pilot corrected him."

Out of sleep
Out of gas

An aviator, not on active duty, was assigned a shift change in his civilian occupation which required him to work from 2300 hours to 0700 hours. Accustomed to working daylight hours and sleeping nights, he underwent a change in his sleeping pattern which resulted in 5½-6½ hours of restless, unsound sleep. Four days after the shift change, he took off for a cross-country training flight in an O-1A.

Aviator (approximately 1 hour and 40 minutes after takeoff): ". . . My engine quit and I made an approximate 180° turn, looking for a suitable landing area. I set up my glide and switched to the auxiliary fuel tank with no result. I turned on my fuel pump and worked the throttle a couple of times, still not getting the engine to run.

"I tried an engine restart, to no avail, and started lowering the flaps to make the field I had picked.

"I saw that I was going to overshoot my field and there were power lines and trees at the end. I pulled back on the stick to avoid the wires as much as possible, but I still hit the upper two strands and then hit some trees on the other side of the road, coming to rest in a field about 100 feet from the road. I turned off my battery, generator, and magneto switches and got out of the aircraft. . . ."

Investigation narrative description: ". . . According to the pilot's statement, the engine quit without any prior indication of trouble. His first action was to turn the aircraft approximately 180° into the wind. By test, this turn required approximately 29 seconds. At this point, he switched the fuel selector valve from the main tank where it had been since runup prior to takeoff to the auxiliary tank position. He attempted a restart for approximately the next 11 seconds, by turning on the electrical fuel pump, opening and closing the throttle, and depressing the starter button.

Out of gas

"By this time, he was well into his selected landing area and had to focus his attention on landing the aircraft. He stated that he lowered the flaps to the 60° position, but saw he was going to overshoot the field. At the end of the field there was a high voltage electrical line, and a row of trees just beyond. The pilot stated that he partially raised his flaps in an attempt to stretch his glide.

"He pulled the nose of the aircraft up, but struck the two top wires. The aircraft continued forward, hit the trees, and cart-wheeled around the right wing before it struck the ground. . . ."

Investigation narrative analysis: ". . . From interviews with the pilot, conducted by the board and by the medical officer, the board concluded that the pilot was physically and mentally impaired and probably should not have flown on the day of the accident. . . .

"The board concluded that the fuel supply was exhausted from the main fuel tank after 1.8 hours of flying. The pilot's delay in switching the fuel selector valve to the opposite tank, and improper emergency procedure, caused a delay in the response of the engine to the fuel from the auxiliary fuel tank. A test conducted by board members showed that a similar delay, with the propeller windmilling and the fuel selector on an empty tank, results in approximately a 10 second delay in response to fuel from the other tank with the electric fuel pump operating.

"The pilot's attention was channeled during each phase of the sequence of events — turning into the wind, attempting to restart the engine, and attempting to land. Because of this channeled attention, none of the phases were done with proper technique, nor were they completed properly.

"In the opinion of the board, based on the expert opinion of the medical officer, this breakdown in habit pattern and inability to adequately respond to the emergency was entirely normal for a person in the pilot's physiological condition at the time of the accident."

Medical officer: "The pilot, after several days of an inadequate sleep habit pattern, prepared for and flew a routine mission. He did not realize that he was probably tired and that his fatigue would result in a delayed reaction time and would also slow or diminish his mental acuity. When he was suddenly confronted with an emergency landing situation, he was not completely capable of quickly and correctly performing the necessary emergency landing procedures. . . ."

Lack of sleep caused O-1 pilot to respond with out of sequence and incomplete emergency procedures when fuel was exhausted from the main fuel tank

OVERTORQUE

UH-1D aircraft commander: "At approximately 1545 hours, we took off from the forward refueling point. We were yellow 4, last in a flight of four aircraft. I was flying. At about 100-150 feet above the ground, the aircraft yawed a little to the left. It straightened right back out, and I thought we had just flown through the turbulence of the other aircraft in the flight.

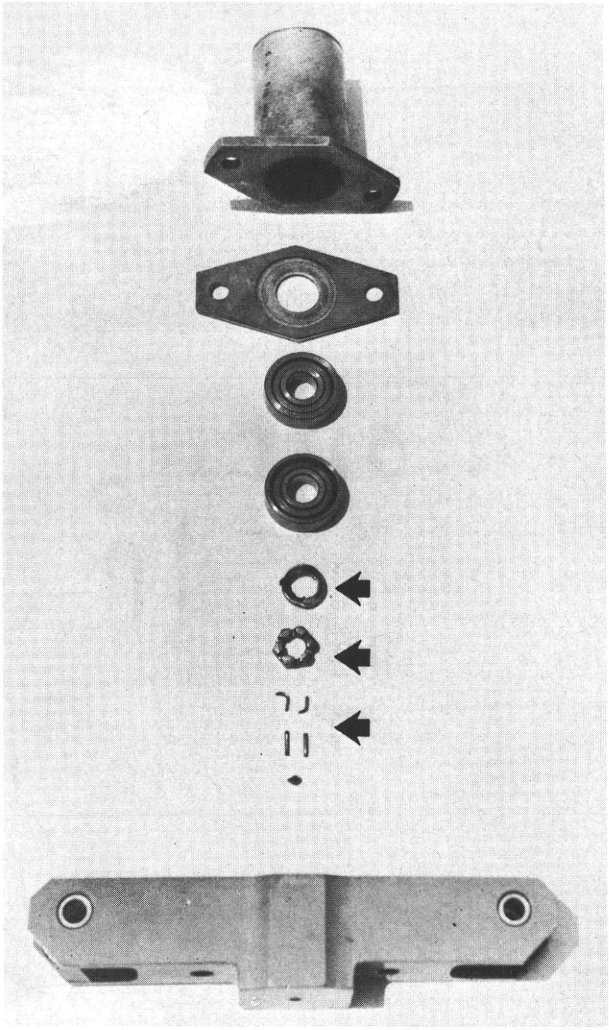
"There was another yaw and a shudder. At that point, the pilot got on the controls with me and lowered the collective pitch to the bottom. There was a big open field directly ahead of us and we headed for it to make a precautionary landing to check the aircraft over. The approach was directly into the wind at about 45 knots and shallow.

"At 3-5 feet above the ground, pitch was applied to cushion the touchdown. The touchdown was gentle and straight ahead, but the nose yawed approximately 45° to the right. The aircraft moved about 5 feet in that direction, then the cross tubes failed, and the aircraft dropped to the ground. I immediately turned off all switches and had the crew depart to determine if there were any fuel leaks."

Investigation board: ". . . The board concluded that the hexagonal retention nut on the tail rotor pitch change drive shaft failed due to improper torquing. This is considered to be the primary cause of this accident.

"Improper pilot technique was considered as a possible secondary cause or contributing factor to the accident. This possibility was rejected because both the statements and other available evidence indicated that the aircraft commander and pilot followed the most logical procedure under the existing circumstances.

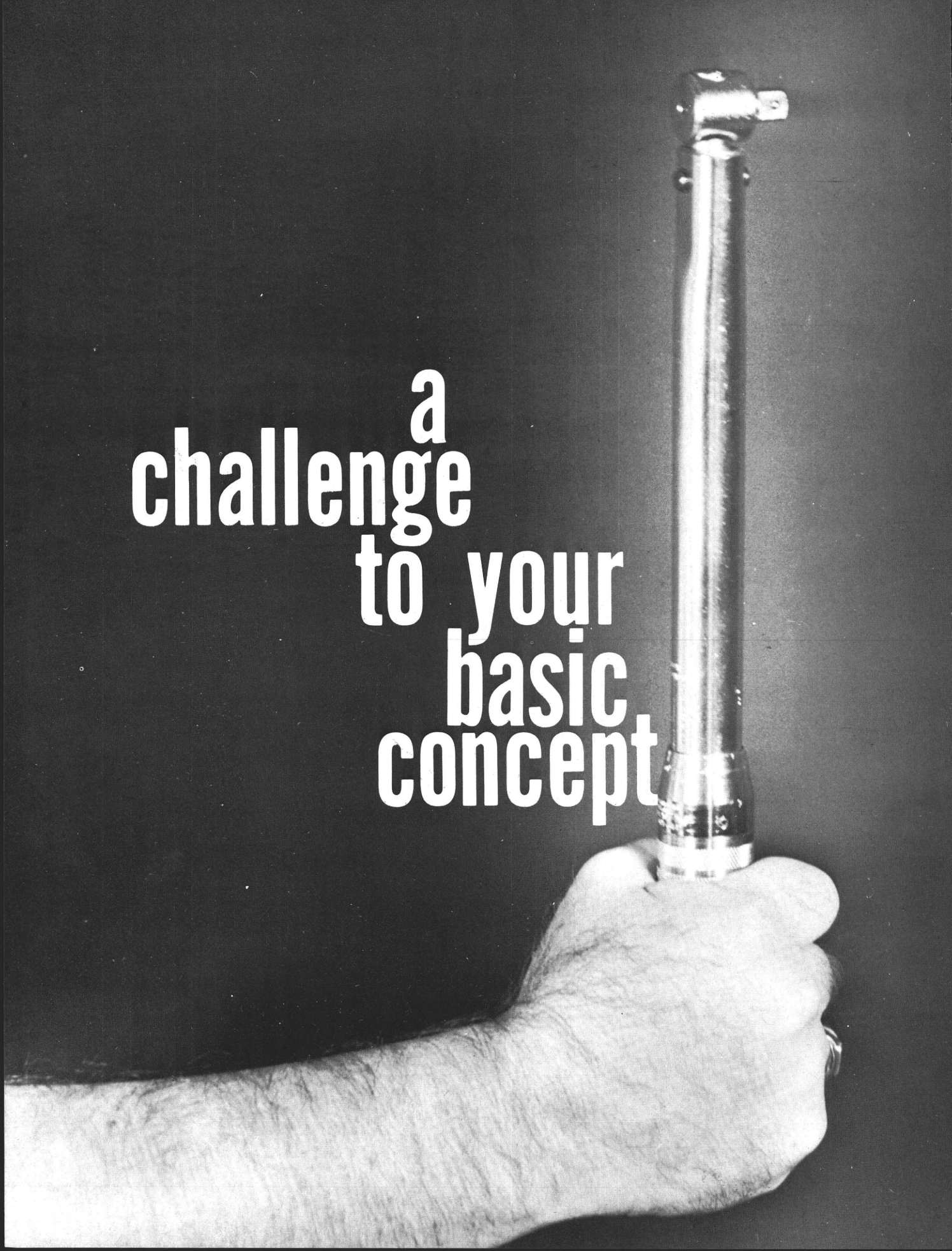
"When they elected to complete a precautionary landing with power, there was no indication of a complete loss of antitorque control. Normal aircraft control was apparently maintained to the point of touchdown and, as substantiated by the initial skid marks on the ground, the aircraft was initially set down aligned with the landing direction. It was concluded that the final and complete loss of antitorque control occurred at nearly the same time as touchdown, therefore affording no opportunity to react as the sudden yaw forced the aircraft sideways on its landing gear."



Stripped hexagonal nut, washer, and broken cotter pin (arrows) of UH-1D tail rotor pitch change drive are evidence of the result of improper torquing

It was determined from the aircraft maintenance records that the last work performed on the tail rotor was during the ninth periodical inspection. This work included removal of the tail rotor assembly, balancing of the tail rotor blades, and reinstallation of the assembly.

Writing in the fall 1966 issue of OVERCAST, Major Charles C. Frank, aviation safety officer, 10th Aviation Group, challenged aircraft maintenance personnel about their basic concepts of torque.


a
challenge
to your
basic
concept

MAJOR CHARLES C. FRANK

Properly torqued nuts are the very essence for reliability in our aircraft. This article will challenge some erroneous concepts that originated with the advent of precision aircraft construction . . .

The chances are 20 to 1 that the next requirement to check the torque on a critical component on your aircraft will be done incorrectly. If you are a mechanic you will do it wrong, and if you are a maintenance supervisor, you will authorize it to be done that way.

This article will challenge some erroneous concepts that originated with the advent of precision aircraft construction and has continued unabated ever since!

The Army has gone to considerable time and expense to publish pamphlets, TMs and FMs that define terms of common usage. Unfortunately, the definition of retorque and check torque are conspicuously absent. The Transportation School recently advised us that there is a shortage of written material on the torque wrench. Their references for teaching are mostly Air Force and civilian publications. It was brought out that the Doctrine and Literature Department of the Transportation School plans to write a complete section of a manual on the torque wrench in the near future. Unfortunately, this does not help us now.

A torque wrench measures the amount of pull required to overcome the friction between the nut and its mating surface. It is *related* to the tension load imposed on the bolt or shaft. The friction being measured is influenced by the type materials and smoothness of the nut and washer. The presence of lubricants on the threads or mating surfaces, and the condition of the threads will also affect the actual tension imposed on the shaft.

From TM 55-1520-209-35 the following instructions relating to checking the CH-47 rotor head retaining nut after a rotor head has been reinstalled and operated are:

"Retaining Nut Torque Check. (After removing the nut cover and lock-wire from the hub retaining nut) check the torque value (using the appropriate wrench). A reading of 152 to 223 pound feet on the torque wrench dial will give the proper torque value."

If you initially torqued the retaining nut to 223 lbs., how would you properly *verify* what the torque was, using these instructions?

From TM 55-1520-210-20 the following instructions pertain to checking the security of the UH-1 tail rotor hub assembly after it has been reinstalled:

"Note: After five hours operation, check torque on the tail rotor retaining nut."

How do you perform this correctly? Some maintenance personnel initially torque to the high value. After the assembly is operated, the torque wrench is set for the minimum value; force is applied to the wrench and it clicks without moving the nut. Do you feel they have verified the torque? If so, please read on.

In both of these cases, the retaining nuts lock their respective components to split cones. If foreign particles were present on the cones during

A CHALLENGE

their installation, then a period of run in should cause them to seat properly resulting in a reduction of tension in the shaft. Hence, a retorque is in order. If during the "check torque requirement" the nut moved, would it then require the lapse of another period and then "check torque" again?

A research of aircraft manufacturers policies on this point brought out the following conclusions:

a. Mr. McGuigan, Chief of Bell's structures group investigated, and Mr. Derwanik from the service division reported.

Retorque and check torque are synonymous. To check the torque value of a tightened nut is nigh-on impossible. The nut must turn to establish a value. It is recommended that the nut be backed off below minimum torque value, then re-establish it to the desired value. This *verifies* that the torque is *correct* and ready for 95 hours of operation before the next PE. Relaxing the nut does not constitute the need for another check in five hours, as is the popular misconception. Loosening the nut below the minimum value simply takes some tension, or stretch, out of the shaft. It does not cause separation of the components being held together. When the nut is retightened, the shaft is stretched under tension to the predetermined length, which is related to the friction induced, and read as a torque value on the wrench.

b. Vertol policy was researched and reported by Mr. Ray Spear who confirms this procedure on their aircraft.

A report from the General Subjects Division, Academic Training Department at Fort Eustis, sent the following reply which is reproduced in part:

"1. ..... There is no way of accurately checking the amount of torque applied (to a tightened nut).

"2. For further discussion we offer the following: It is the consensus of opinion of our most senior instructors that it is customary for the TI to be present when any critical torque is being applied. We can see no advantage where the mechanic performs the torquing and then calls the TI over to check the work. As stated earlier, there is no accurate way to check the torque and the TI is placed in a compromising position of having to sign off the work without knowing what the torque is. We would also like to point out the majority of installations would probably be incomplete at this time anyway, as critical torquing areas usually require some form of safetying. As long as the TI is responsible for the complete installation, why not have him present while the torquing is being performed so he knows the correct pressure has been applied? A general rebut to this is a lack of qualified TIs in most operational units. But I feel you will agree it takes less time to watch a man torque an installation than it would be to try to check the torque by some devious means that is not guaranteed to be accurate."

The instructions included with each Army issued torque wrench, but apparently seldom read, are included in part:

a. While the torque wrench is being used for assembling units, tighten the nut or screw. When the specified torque is approached, keep the nut or screw moving with a steady sweep of the wrench until the specified torque is reached.

NOTE: A fast or jerky motion will result in an improperly torqued fastener.

b. If the torque wrench is being used for retightening and checking screws or nuts, a slightly different technique is used. Because of the adhesion, or "set" that takes place between the threaded and other mating surfaces if motion is stopped, even momentarily, the torque indication is valid only when the nut or screw is moving. Even when a screw is under less than desired tension, more than the specified torque is usually required to start it turning. Therefore, when a torque wrench is used for retightening or checking, the nut or screw must be started before the torque readings are taken. Back off the screw or nut so that less than specified torque is required to start it in the proper direction. When the specified torque is approached, the nut or screw must be kept moving with a steady sweep of the wrench until the required torque is reached.

One unexplained UH-1B/540 accident resulted from the loss of a tail rotor assembly. The failure was preceded by high frequency vibrations. It occurred 8 hours after the tail rotor assembly was reinstalled and 3 hours after the "torque check." The mechanic who checked it had set the minimum torque value on the wrench, and the bolt did not move when the wrench "clicked." He was satisfied.

Properly torqued nuts are the very essence for reliability in our aircraft. Overtorquing may cause a bolt to fail faster, in many cases, than undertorqued fasteners, but either condition will cause parts to fail. You may work hours reassembling your aircraft, only to have your careful work nullified in the final step when an improper torquing application builds into the component an eventual failure.

Using The Torque Wrench

As a further aid in explaining the hows and whys of torque, the following article was adapted from the October 1966 issue of APPROACH magazine

The operation of a torque wrench is not complicated. However, to properly use a torque wrench, the mechanic must possess a basic knowledge of torquing mechanics, and as with any precision measuring tool, must exercise a reasonable amount of care and skill.

Reading Torque—With the indicating dial-type wrench, the torque is read on the dial as the force is applied. With the audible or click-type wrench, the torque is present on the wrench by releasing the lock in the end of the handle and rotating the grip to the desired torque setting. When the preset torque is reached during the tightening operation the handle will automatically release or "break" producing approximately 15° to 20° of free travel. This release is distinct, easily detected by the mechanic, and indicates completed torquing action on the fastener.

Tightening Head End—When a fastener is tightened from the head end, some of the torque applied is absorbed in turning the bolt in the hole. The amount of torque absorbed will vary depending on the clearance in the hole and the alignment of the parts. For this reason torque values are specified for tightening fasteners on the nut end. However, in some instances it will be necessary to tighten the fastener from the head end. On these occasions the fastener should be tightened to the high limit of the torque value specified.

New Nuts—It is good practice in torquing, especially in torquing new bolts and nuts, to first tighten the fastener to the desired torque and then loosen the nut or bolt by backing off approximately one-half a turn. Then retorque to the specified torque.

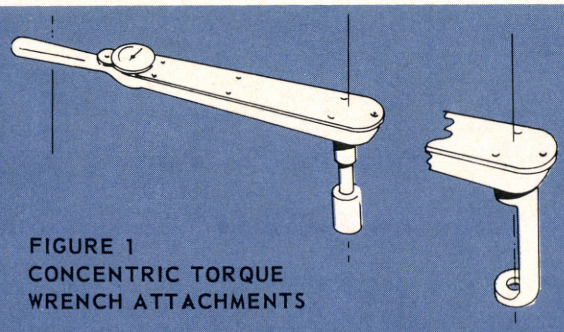


FIGURE 1
CONCENTRIC TORQUE
WRENCH ATTACHMENTS

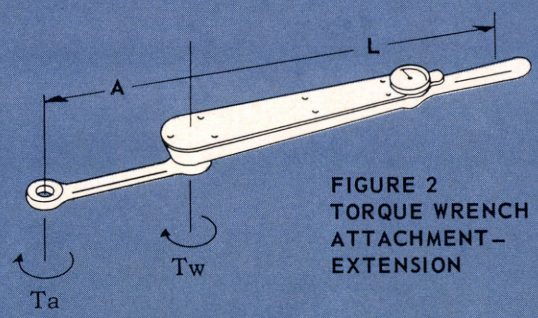


FIGURE 2
TORQUE WRENCH
ATTACHMENT–
EXTENSION

Tw = Indicated torque on the torque wrench
Ta = Actual torque applied to the fastener
L = Lever length
A = Attachment length

$$Tw = \frac{Ta \times L}{L + A}$$

EXAMPLE

Ta = Desired torque = 300 lb. inches
L = 10 inches
A = 4 inches

$$Tw = \frac{300 \times 10}{10 + 4} = \frac{3000}{14} = 214 \text{ lb. inches}$$

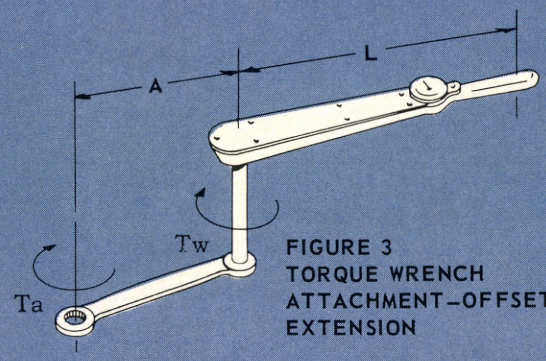


FIGURE 3
TORQUE WRENCH
ATTACHMENT–OFFSET
EXTENSION

Tw = Indicated torque on the torque wrench
Ta = Actual torque applied to the fastener
L = Lever length
A = Attachment length

$$Tw = \frac{Ta \times L}{L + A}$$

USING THE TORQUE WRENCH

This aids in cleaning and smoothing the threads and results in more accurate torque.

Aligning for Cotter Pins—When a nut is to be secured to a fastener with a cotter pin or wire, the nut should be tightened to the low limit of the torque specified and the hole aligned by a tightening operation. *Never loosen a castellated nut to obtain alignment.*

Thread Lubrication—Threads must be clean and free from nicks, burrs, paint, grease or oil to obtain the correct tension or preload in the bolt when it is tightened to the specified torque. However, there are some applications where lubrication or anti-seize compound is used on the threads. The maintenance manual should be consulted with regard to the torque value for lubricated threads when specified.

Check Pre-Torqued Nuts—Checking fasteners accurately to determine if they have been tightened to the specified torque value is not possible. A fastener that has been tightened to a specified torque requires approximately 10 percent more torque than was originally applied to overcome friction and start the fastener turning. When there is doubt as to whether a fastener has been tightened to the correct torque, the fastener should be backed off from one-half to one full turn and retightened to the correct torque value. A torque wrench should be used for the back-off operation.

Use of Attachments—Many torque wrench applications will require the use of attachments such as adapters and extensions to reach fasteners in places of limited accessibility or to position the torque wrench so that the dial is more easily read.

Concentric Attachments—The use of an attachment which operates concentrically with the drive square of the torque wrench presents no particular problem, since the effective length of the wrench is not lengthened or shortened. The torque applied to the fastener will therefore be the torque indicated on the dial. Figure 1 illustrates typical attachments of this type. These attachments may also be used on the preset, sensory or audible type torque wrenches without affecting the torque setting.

Nonconcentric Attachments—On some torque applications, an attachment will be used on the torque wrench that does not operate concentrically with the drive square. An attachment of this type has the effect of lengthening or shortening the lever length, and the torque value shown on the dial is not the torque that is applied to the fastener. When using these attachments, it is necessary to calculate

the effect of the lever length to determine the correct torque reading. Figure 2 illustrates an attachment that adds to the lever length with the applicable formula for obtaining the correct torque reading. The same formula applies to the attachment illlustrated in figures 3 and 4. In these cases of added lever length, the indicated torque is smaller than the actual torque.

Attachments when used as illustrated in figure 5, shorten the effective lever length. In these instances, the attachment length, A, is subtracted in the formula and the indicated torque is greater than the actual torque.

In using these formulae, the lever length, L, is a critical factor. On a flexible beam-type wrench with a pivoted grip, this dimension is fixed and the pivot point of the grip determines the point of force application and therefore the length of the lever. On the rigid frame and presetting audible click-type wrenches, the point of force application must be in the center of the grip as shown in figure 6.

In figure 5-6, using the 10-inch lever length, 107 pound-inches of torque as read on the torque wrench, results in 150 lb-in of torque on the fastener when the force is applied correctly to the center of the grip.

If the force were applied to the torque wrench at the tip end or the root of the grip as shown in figure 7, at the same 107 pound-inch reading, the torque applied to the fastener would be 142.6 lb-in and 160.5 lb-in respectively.

Angle Attachments—Attachments will not always extend straight from the end of the torque wrench. In instances where the centerline of the adapter is not in line with the centerline of the torque wrench as illustrated in figure 8, the length of the adapter is not used. The effective length used to calculate the torque reading is the distance A in figure 8.

Torque Multipliers—The direct application of torque to a fastener is limited by the force that can be applied by a man and by the length of the wrench. The force a man can apply to a lever varies to some extent but is approximately 100 lbs. With a wrench 30 inches long, the torque that can be applied is 100 x 30 or 3,000 lb-in (250 lb-ft). Higher torques are possible with longer wrenches; hower, there is a limit to the size of a wrench that can be used effectively by one man. Torque multipliers are used for the high torques such as those specified for engine thrust nuts, propeller, and helicopter rotor hub nuts. Figures 9 and 10 illustrate typical torque multipliers. They are available in ratios from 3 to 1, to 11.1 to 1. Multipliers must be an-

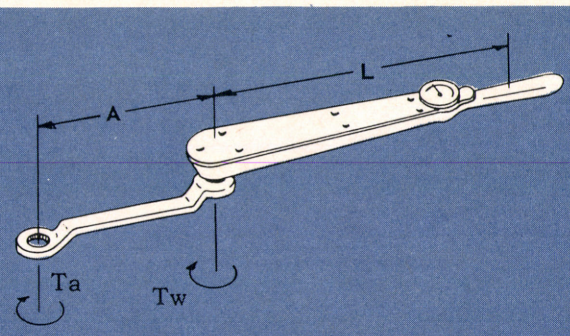


FIGURE 4–TORQUE WRENCH ATTACHMENT–OFFSET EXTENSION

Tw = Indicated torque on the torque wrench
Ta = Actual torque applied to the fastener
L = Lever length
A = Attachment length

$$Tw = \frac{Ta \times L}{L + A}$$

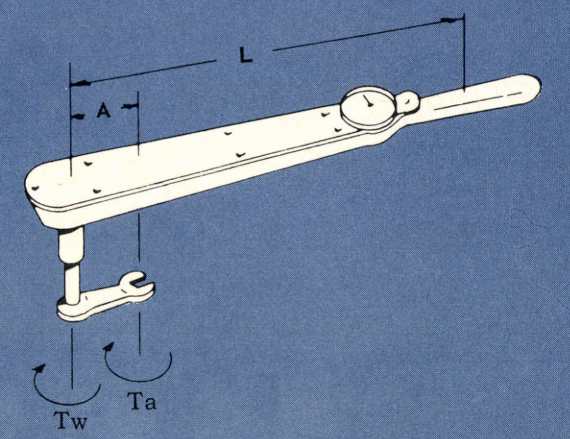


FIGURE 5–OFFSET REVERSE EXTENSION

Tw = Indicated torque on the torque wrench
Ta = Actual torque applied to the fastener
L = Lever length
A = Attachment length

$$Tw = \frac{Ta \times L}{L - A}$$

EXAMPLE

Ta = Required torque = 200 lb. inches
L = 12 inches
A = 2 inches

$$Tw = \frac{200 \times 12}{12 - 2} = \frac{2400}{10} = 240 \text{ lb. inches}$$

USING THE TORQUE WRENCH

chored or secured to a structure relative to the fastener being tightened, or be fitted with a reaction bar to prevent the multiplier from turning. For this reason, their use is usually restricted to special applications. When using a torque multiplier, the torque to be applied with the torque wrench is determined by dividing the specified torque for the fastener by the multiplier ratio. For example:

If the torque specified for the fastener is 3,000 lb-ft and a torque multiplier with an 11.1 to 1 ratio is going to be used, then 3,000 ÷ 11.1 or 270 lb-ft is the torque applied by the torque wrench. In this case a 350 lb-ft capacity torque wrench or a wrench up to 900 lb-ft capacity would be used to apply 270 lb-ft of torque to the input of the torque multiplier. In this range of torque wrenches, the applied torque is between the desired 30 to 80 percent range.

CARE OF TORQUE WRENCHES

Storage—A torque wrench is a precision measuring tool and when handled and used with reasonable care will remain accurate and serviceable for a considerable period of time. Torque wrenches should never be carelessly tossed among other tools. They should be stowed in a clean, dry place where they will not be subjected to shock or damage.

Handling—A torque wrench should never be dropped to the floor. If this does happen, the wrench should be checked for accuracy before being used again.

Alterations—The frame is the measuring element on a flexible beam-type wrench. Any alteration to this frame will seriously affect the accuracy of the wrench. Do not file, mark, or etch the beam in any way.

Overloading—A torque wrench should be used with care to avoid loading the wrench in excess of its capacity. Overloading a torque wrench can result in permanently deforming the torque sensing element and damaging the wrench.

Testing

Reason for Testing—A torque wrench is subject to wear and other factors which can be detrimental to the accuracy of the tool. Periodic testing in accordance with applicable directives is essential to ensure continued accuracy. Torque wrench testers are provided through allowance lists.

Types and Operating Principles of Testers—Several different types of torque wrench testers are manufactured, and to ensure their proper use, some

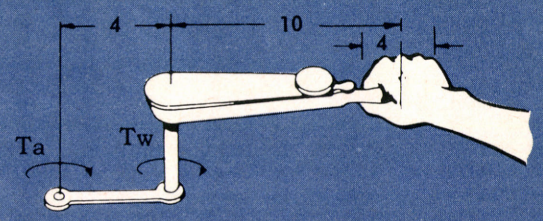


FIGURE 6—PROPER APPLICATION OF FORCE WHEN USING EXTENSIONS

Ta = Required Torque = 150 lb. inches

$$Tw = \frac{Ta \times 10}{10 + 4} = \frac{150 \times 10}{10 + 4} = \frac{1500}{14} = 107 \text{ lb. in.}$$

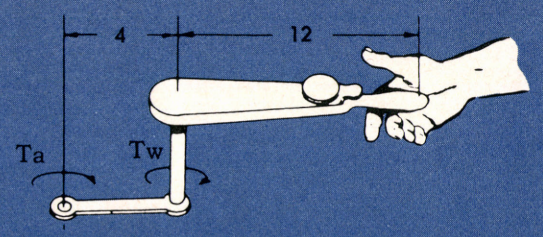


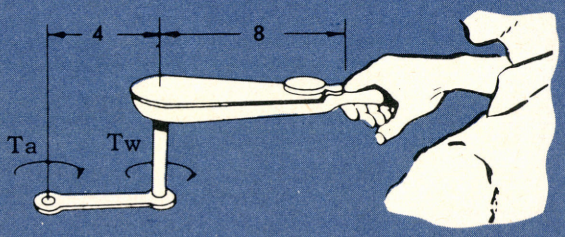
FIGURE 7—IMPROPER APPLICATION OF FORCE

Tw = Torque Wrench Reading = 107 lb. inches

$$Ta = \frac{Tw \times (L+A)}{L}$$

$$Ta = \frac{107 \times (12 + 4)}{12}$$

$$Ta = \frac{107 \times 16}{12} = 142.6$$



Tw = Torque Wrench Reading = 107 lb. inches

$$Ta = \frac{Tw \times (L+A)}{L}$$

$$Ta = \frac{107 \times (8 + 4)}{8}$$

$$Ta = \frac{107 \times 12}{8} = 160.5 \text{ lb. inches}$$

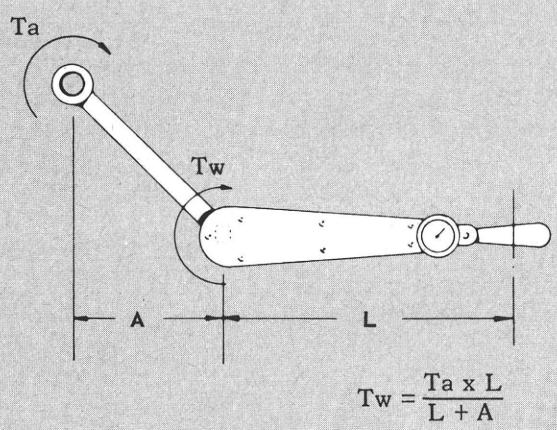


FIGURE 8–TORQUE WRENCH ATTACHMENT–ANGLE EXTENSION

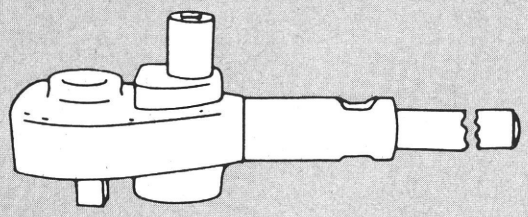


FIGURE 9–TORQUE MULTIPLIER–GENERAL USE

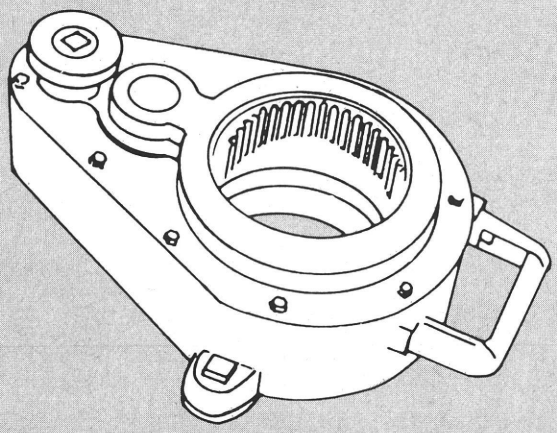


FIGURE 10–TORQUE MULTIPLIER FOR HUB NUTS

understanding of their operating principles is desirable.

A torque wrench tester consists of a force resisting element to absorb the load applied by the tool and a dial or scale to indicate the magnitude of the applied load in torque units. A maximum reading pointer is provided that remains at the point of maximum applied torque and holds the reading when the load is released until reset to zero by the operator.

The force resisting element may be a weight, a steel spring, a torsion bar, or strain gage load cells. The movement or deflection of the force resisting element resulting from the application of the load applied by a torque wrench is relatively small and must be magnified in order to indicate the small variations in the amount of the applied load. Magnification is accomplished on mechanical type testers by a gear segment and pinion or a mechanical linkage. Other types of testers use optical magnification or electronic amplifiers.

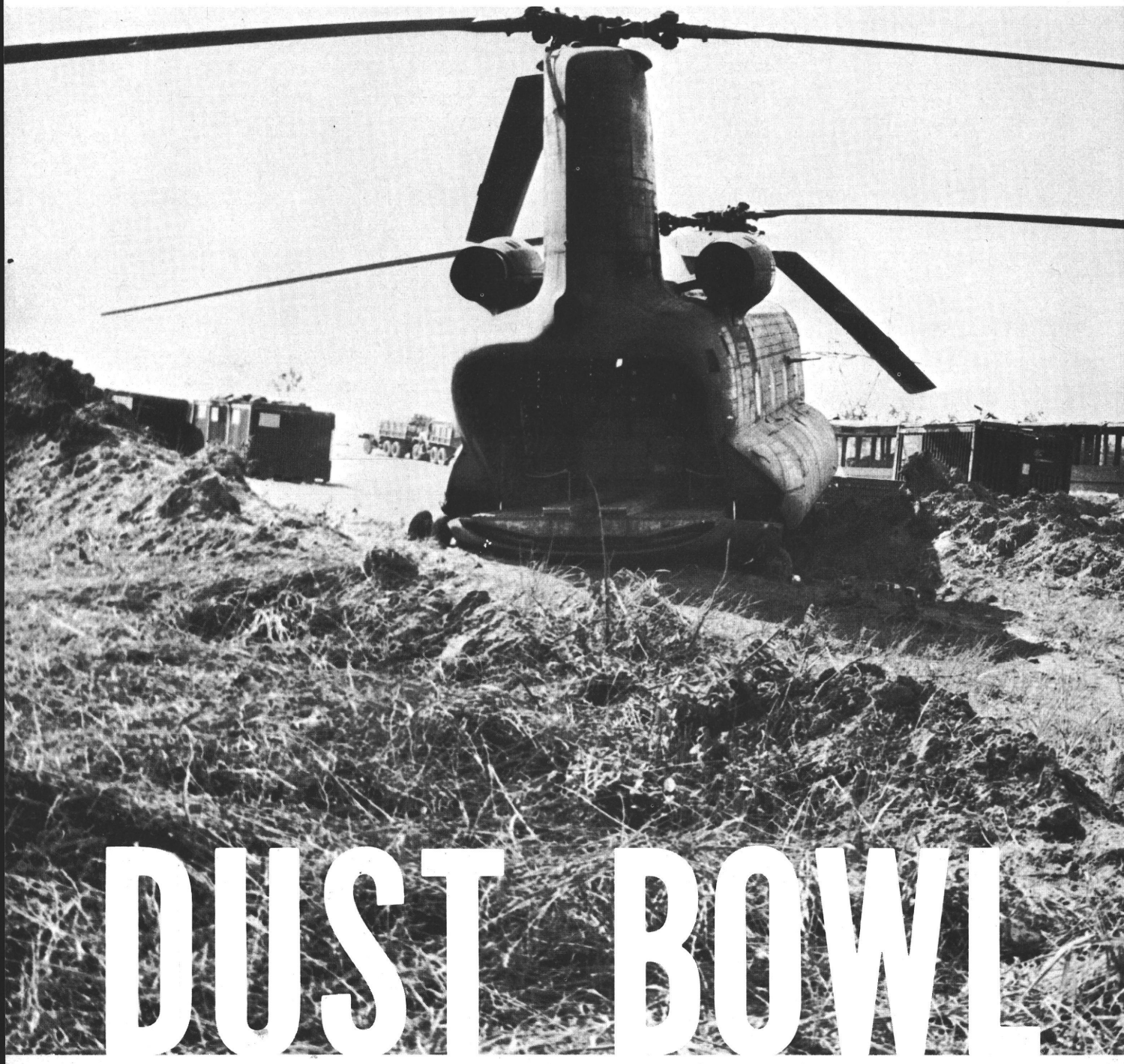
How a Tester Is Used—A torque wrench tester is a precision measuring instrument and reasonable care is required to obtain accurate readings. A load in excess of the capacity should never be applied to a torque wrench tester as this may damage the instrument and destroy the accuracy.

A tester for manual torque wrenches should never be used for checking a powered torque tool such as a nutrunner or impact wrench.

To test a torque wrench, the wrench is applied to the tester in the same manner as it would be used on a nut or bolt. A socket or adapter is used to connect the drive tang of the wrench to the input of the tester. Torque wrenches should be tested for accuracy at approximately the 15, 40, 65 and 90 percent points of the range. A minimum of three readings should be taken at each point.

When testing a flexible beam or dial type torque wrench, a predetermined torque, indicated by the torque wrench dial or scale, is applied to the torque wrench tester. The load is then relieved and the torque indicated by the maximum reading pointer on the tester is noted and compared with the torque value applied by the torque wrench.

When testing an audible sensory type torque wrench, the wrench is preset to the desired torque and applied to the torque wrench tester. The reading on the tester is observed as the torque is applied. Care must be exercised to note the torque indicated when the wrench clicks or "breaks" since the snap action of the wrench may cause the maximum reading pointer to override and give a false indication of the applied torque.



DUST BOWL

. . . both the pilot and IP were spatially disoriented due to dust and caught only glimpses of recognizable objects . . .

Accident report narrative: "With a 9,213 pound load and a crew of five aboard, a CH-47A was on a pad in an area named the "dust bowl" by local pilots. At 32,600 pounds gross weight, the helicopter was within maximum gross weight and c.g. limits, but 807 pounds in excess of the amount the pilot had requested. The loading and tie-down was rushed from the start, with only a 15 minute interval planned between each aircraft using the pad.

"The pilot and instructor pilot had the engines started and ready to go by the time the flight engineer, gunner, and crewchief completed tying down the load. At this point, another CH-47A was orbiting overhead waiting to land.

"The pilot started the takeoff at the controls with the IP assuming the duty of maintaining rotor rpm with the normal beep trim control. As thrust was applied, rotor rpm was lost. The engines failed to respond to applied beep trim and there was a continuous drop in rotor rpm.

"As the helicopter moved off the PSP helipad, it was enveloped by a heavy dust cloud so that both the pilot and IP lost visual reference to the ground and became spatially disoriented. The helicopter continued to lose rotor rpm and the IP took control to attempt a landing. The Chinook traveled some 90 meters and turned approximately 120° to the left. It was now in a quartering tail wind from the right, and the rotor rpm had dropped to approximately 190. The helicopter settled to the right and down, hit a row of conex containers with the right side of the loading ramp, then rode up over the containers, resulting in the lateral shear of the left rear landing gear on the containers. At this point, the IP pulled more thrust, causing the stability augmentation system to become inoperative due to low rotor rpm. The remaining thrust cushioned the landing. The left front gear made first ground contact, followed by the right rear gear, and then the right front gear. The right sideward motion of the aft portion of the helicopter sheared the locking pin on the right aft gear. The aircraft came to rest between a double row of conex containers, a mound of dirt, and a small building. There was major damage to both aft gear, their attaching points, and the ramp."

Analysis: Dust in the area was known to be a problem. The landing pad was the only one available and the primary method of resupply was by CH-47. New helipads were under construction, but not completed. The aviators were reluctantly using the pad, and other aircraft on the same mission came in after the accident and successfully completed landings and takeoffs. Dust was definitely a contributing factor. However, if proper technique had been exercised, adequate power and rpm could have been maintained and a successful takeoff completed. . . .

"Density altitude was a factor and was computed to be 2,200 feet by the board. Load was a factor in that the pilot had 807 pounds in excess of his request. Had he expected the increased load, it may have influenced his takeoff procedures or caused the more experienced IP to make the takeoff.

"Psychological factors were a problem. There was haste so as to clear the area for the second incoming aircraft. . . . Also, the pilot was anticipating the dust during takeoff and may have applied thrust too rapidly to try to reduce the amount of time within the dust cloud. In addition, there were high tension wires perpendicular to the takeoff path at a distance of 200 meters.

"Physiological factors were also involved. The aviators were flying in hot humid conditions which caused a high rate of fatigue. They were flying under hazardous conditions and with heavy loads which further increased fatigue. Dust entering the cockpit undoubtedly interferred with the pilots' vision and contributed to their spatial disorientation.

"Design criteria was not established as a factor. There were two known instances in which a CH-47 pilot was found to have pushed the engine beep trim control when attempting to run out the search-

" . . . the IP allowed the pilot to attempt a takeoff without determining if sufficient power was available."

light. These two control buttons are located adjacent and feel similar. It is impossible to establish that in this case the IP pushed the searchlight control when trying to beep the engines up. If this error were established, it could be the major contributing factor to this accident.

"Operating procedures were a major contributing factor. The IP and pilot allowed themselves to become overly rushed. The correct gross weight was not established prior to the attempted takeoff, and due consideration was not given for gross weight vs density altitude. The cockpit procedure was possibly out of sequence, as one statement referred to the pilot as having started the APU. The engines were believed to have been started without a fire guard, as the crew was still tying down the load.

"The accident sequence began as the pilot applied thrust to lift the helicopter from the ground to start the takeoff. The rotor rpm immediately dropped. The helicopter was then off the PSP landing pad and heavy dust increased beyond expectations as the helicopter failed to break into translational lift. The IP added engine beep trim to increase rpm until he felt the engines were at maximum power. During this time, the pilot continued to apply thrust in order to get the helicopter flying and out of the dust cloud.

"With rpm continuing to decay, the IP took control to attempt a landing. By this time, both the pilot and IP were spatially disoriented due to dust and could catch only fleeting glimpses of recognizable objects . . . Both the IP and pilot reported a continuous decay of rpm, even when they lowered thrust in an attempt to regain what was lost. . . . "

DA Form 2397-4: "The primary cause was that the IP allowed the pilot to exercise improper technique by excessive application of thrust which exceeded the N2 power available, causing the engines to operate on the back side of the power curve, and resulting in the continuous loss of rotor rpm.

"Contributing factors:

"1. During the takeoff attempt, the helicopter moved forward off the PSP pad over the unprepared surface, creating a heavy dust cloud from the rotor downwash and resulting in the pilots' loss of visual reference to the ground.

"2. The combination of the 2,200 foot density altitude and the additional 807 pounds of payload over that specified by the pilot caused the helicopter to fail to respond in the expected manner and contributed to the pilot's continued application of thrust.

"3. Neither the IP nor the pilot were using their APH-5 face shields while dust entered the cockpit through open windows."

"Recommendations:

"1. That all CH-47 qualified aviators be informed of the causes of this accident.

"2. That CH-47 transition courses place maximum emphasis on operations at maximum gross weight with high density altitudes.

"3. That cockpit windows be closed and that aviators' APH-5 face shields be down during all CH-47 landings and takeoffs in known or suspected dusty areas.

"4. That an axle load indicating system, to work off the internal pressure of the oleo struts and give a direct cockpit reading of the gross load, be installed in CH-47 helicopters. This device will ensure safety of operations and enhance the maximum use of the load capacity of the helicopter."

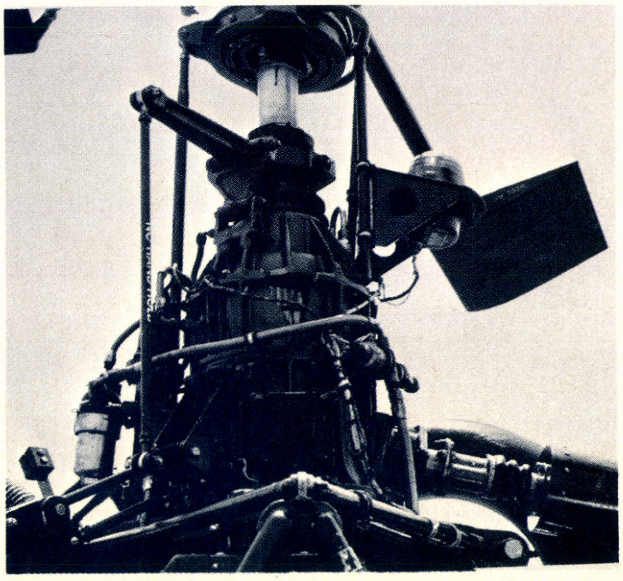
Commander's letter of transmittal: ". . . .Nonconcur with the primary cause as written. Simply stated, the IP allowed the pilot to attempt a takeoff without determining if sufficient power was available.

"Concur with the contributing factors and recommendations of the board. . . ."

Note: USABAAR has been advised that an axle load indicating system is currently under study by AVCOM. The U. S. Army Aviation Test Board programmed the test of this system during January 1967.

$17,800 MACHINE SCREW

Heavily damaged OH-23D resulted from foreign object damage which caused transmission failure. Several pieces of a small machine screw were found in the transmission.



Transmission housing was broken (arrow) when transmission failed due to foreign object passing through gear mesh. Analysis report stated that failure was sudden and rapid.

An OH-23D was making a landing approach. Pilot: "At approximately 125-150 feet, I felt a jarring to my rear. I glanced forward, saw no engine rpm, bottomed the collective, and flared at about 35 feet. I pulled pitch at about 10 feet and, just before touching the ground, I pulled pitch again. I hit the ground and immediately called the tower and said that I had crashed. The engine was not running, but I cut off the magnetos, master switch, and fuel before getting out of the aircraft."

IP witness: "I first saw the helicopter at approximately 100 feet. Its airspeed appeared to be low, with a high rate of descent. A flare was started at approximately 40 feet. . . . At approximately 12 feet, the nose came up a little more and the ground was contacted by the pogo stick first. It collapsed, followed by tail boom contact with the ground. As the tail boom struck, the main rotor blades struck portions of the tail boom and parts of the aircraft exploded in all directions. The tail boom contact threw the aircraft near level. The helicopter then turned left approximately 150° and came to rest upright."

Investigation board narrative: ". . . Visual inspection of the aircraft revealed cracks in the transmission. The board directed that the aircraft be returned to the maintenance area and the transmission was shipped for analysis. . . ."

Transmission analysis report: "A preliminary teardown analysis was completed and it was determined that the transmission had failed in flight due to the failure of a second stage planetary gear. All indications revealed the failure to be sudden and rapid, resulting from a foreign object passing through the gear mesh. There were no signs of progressive type fatigue of either the gears or housing.

"The only foreign objects found in the transmission were several pieces of a small machine screw. It has the same type thread as the screws used to retain the second stage planetary gear keepers. All of the required keeper screws were intact and safety wired. . . ."

HEAVY

" . . . pilots exceed limitations and capabilities in their willingness to accomplish assigned mission."

UH-1B aircraft commander: "The aircraft was loaded for a unit move. The baggage of the crew that we were unable to load on unit vehicles was loaded on the aircraft to comply with the requirement of a one time lift for all gear.

"After starting the aircraft, I hovered downwind to an area vacated by our lift platoon to provide a longer takeoff run. While hovering to the area, the rpm bled off to 6400. I then ran the aircraft until I had burned off 150 pounds of fuel, leaving 950 pounds on board.

"The lead aircraft called for takeoff clearance and was given a wind from 360° at 4 knots, and a density altitude of 3,400 feet. I departed in a northwesterly direction.

"During the takeoff run, the low rpm audio came on. I thought about aborting the takeoff, but, at the same time, the aircraft felt like it was entering translational lift and I thought it would become airborne. Shortly after this, I decided the aircraft would not fly and started a right pedal turn and flare into a clearing, intending to abort the takeoff. The right skid hit the road bank and the aircraft made a right 360° turn. I decreased the collective to stop the turn and washed out the gear."

Pilot: ". . . The first ship called for takeoff and took off on an approximate 280° heading. We were pointed 300°. The tower gave the density altitude as 3,400 feet, which I knew to be wrong and so remarked to the aircraft commander. He picked the ship up to a hover. All instrument indications were normal and he proceeded to take off.

"As the aircraft moved forward, I saw the rpm drop off. In the conditions under which we operate, this was not an unusual condition. As we proceeded along the takeoff path, we saw that the helicopter would not pick up translational lift in time to clear a barrier.

"The aircraft commander put in right pedal to clear the barrier, which altered the takeoff path and gave us a downhill run over a ravine and large depression through which a road ran. At this point, the aircraft felt as though it was about to pick up translational lift.

"After altering the takeoff path, the rpm continued to be low and the warning light was on. The aircraft commander made the decision to abort the takeoff in a clear area on the other side of the road. As he brought it back to a slight flare, the right rear portion of the skid struck the bank of the road, knocking the aircraft to the left. The aircraft hit hard and slid around 360°, tearing the skids off as it went. We came to a stop in the direction in which we had attempted to land."

There were no injuries, but damages to the helicopter totaled $51,728.

DA Form 2397-1: "The density altitude of 5,090 feet at the time of the accident restricted the capability of the helicopter to operate with a heavy load."

DA Form 2397-4, Accident Cause Factors: "The aircraft was overloaded and the aircraft commander attempted to exceed gross weight limitations for the high density altitude condition (reference: TM 55-1520-211-10, chart 14-7, Takeoff Gross Weight Limitations).

"The requirement for the unit to attempt to move all its equipment in one flight influenced the aircraft commander to attempt to fly the aircraft while exceeding the specified gross weight limitations."

DA Form 2397-4, Recommendations: "Recommend increased emphasis on aircraft weight and balance.

"Recommend all pilots check the N1 gas producer (go-no-go placard) prior to each takeoff, and attempt that takeoff only if the N1 readings indicate sufficient power is available.

"Commanders should not encourage a one time move, place other requirements, or suggest acts which could cause unsafe conditions, without further emphasizing the importance of safety. Commanders should remember that their suggestions can cause pilots to exceed limitations and capabilities in their willingness to accomplish assigned missions."

Unit commander: "Concur with the findings and recommendations submitted by the aircraft accident investigation board. This unit will take the following corrective measures to prevent recurrence of similar accidents:

"1. Helicopter internal loads will be reduced to only those items which are necessary for mission accomplishment and crew survival.

"2. Noncritical items, such as personal baggage or convenience equipment, will be retained at the unit location until transportation is available.

"3. If the organic vehicles assigned to the unit are unable to move this equipment, then a request will be submitted to the appropriate logistical support element for suitable transportation.

"I shall continue to emphasize and impress upon our aviators the importance of avoiding helicopter overloading conditions."

DOWNWIND EMERGENCY

A UH-1D pilot was assigned a maintenance flight to ferry the helicopter to a nearby river where it was to be washed down. In addition to the pilot, a crewchief and gunner were aboard. The helicopter had been stripped of all seats and equipment before the flight.

Pilot: ". . . Our departure was delayed a few minutes by a heavy rainfall. When it stopped raining, we went out to the aircraft. The ship had just come in from the field in the morning. At approximately 1315, I cranked the aircraft to go down to the river.

"The runup was uneventful and everything appeared normal and checked out OK. I called the tower for clearance for closed right traffic. We took off to the north, did a right turn crosswind, then another right turn downwind, which was sort of a dog leg to bring me over to a position to do a 180° turn over the river.

"I had just completed the downwind turn when I heard a metallic bang, a snapping sort of sound, and the engine quit. The last thing I can remember was rolling the throttle off, which was instinct after the engine quit, and putting the pitch down. About the same time, I called the tower and said that we were going down because of engine failure. I remember giving the wrong aircraft tail number.

"Prior to the engine quitting, I estimate I had 27-28 inches of torque, about 90 percent gas producer, at an altitude of 2,000 feet. The ship was empty so there was not much of a load. I had cruise power when the engine quit.

"The next thing I can remember is being in the hospital having my arms cleaned and dressed."

Rated aviator witness: "My attention was brought to the helicopter by an unusual noise. It was flying south at about traffic pattern altitude and it entered an autorotation that appeared to be normal. As the aircraft approached the ground, it went into a steep flare. After hitting the ground, the aircraft turned to the left. I then lost sight of it because of the tree line."

Second rated aviator witness: "The aircraft was flying downwind where I estimated the traffic pattern to be. I then heard a loud metallic zing. At first I thought that someone had fired a rocket from a ship nearby. Then I noticed the aircraft losing altitude. I watched until it was approximately 70 feet from the ground and it went into a steep flare. It then dropped from sight and immediately burst into flames. . . ."

SP 5 witness: "When I first saw the Huey, it was coming over the hill at about 50-75 feet above it. I followed its descent to where it hit the ground about 50 feet from me. The helicopter hit once, bounced, and turned slightly to the right as it came to rest. The cabin area shattered apart and started to burn.

"As I ran to the helicopter I saw two men in the front. I headed to the right side because I had seen someone moving. When I got to him, he was removing his shoulder harness and seat belt. I helped him from the wreckage and went to the left side of wreckage and helped about four other men get the man [crewchief] out. The cyclic stick was wedged up between his legs and the instrument panel was pushed toward him. Someone tore the stick away and the rest pulled the instrument panel forward and away from the man. Neither man had on his flight helmet after the aircraft came to rest."

The aircraft was a total loss and the gunner was killed. The pilot and crewchief sustained major burn injuries.

Flight surgeon: "The aircraft had been refueled just prior to takeoff and there was a large postcrash fire which totally destroyed the aircraft, with the exception of the skids, tail section, and rotor blades. These were broken from the aircraft and scattered in the area. The pilot was wearing gloves and suffered no burns of the hands.. His burns were of the face, the lower arms where his fatigues were loose, and spots on his legs where the fatigues were torn.

". . . The crewchief was sitting in the copilot's seat and his seat and area were burned to a greater degree than the pilot's. Also, he suffered hand burns as he was wearing no gloves. In the crash, he apparently lost his helmet and suffered burns of the scalp, along with scalp lacerations. Although his sleeves were rolled down, due to the looseness of the fatigues, he was burned on the lower arms and also on the lower legs through his fatigues.

". . . The gunner was seated on the floor of the troop compartment behind the copilot's seat. It is unknown whether or not he had a seat belt. . . ."

Investigation board analysis: "Until the engine failed, this was a routine flight, using the established traffic pattern of the heliport. At the time

UH-1D burned after hard impact due to loss of rotor rpm. Intact condition of main rotor (foreground) indicates extreme low rotor rpm at impact.

the engine failed, one or more of these improper emergency procedures occurred:

"1. The pilot did not immediately realize the engine had failed, resulting in an initial loss of rpm which could not be regained.

"2. Improper use of collective pitch during the termination of the autorotation.

"3. Or a combination of 1 and 2.

"This is based on the proximity of the rotor head within the impact area, and the relatively minor damage to the rotor system, compared to the aircraft itself. There was no visible damage to the tail rotor blades.

"The technique used upon termination of the autorotation was not what the pilot would be reasonably expected to do. The aircraft was put into a steep flare and the tail struck the ground with such force that it was torn from the aircraft. It is questionable whether collective pitch was applied, as the aircraft struck the ground with such force that the main cabin structure completely disintegrated, the fuel tanks ruptured, and the aircraft was consumed in flames.

"After final impact, the pilot and crewchief were still in their seats and were extracted by witnesses. The board agrees that the gunner was thrown from the aircraft and that he had no helmet and no seat within the aircraft, because the aircraft had been stripped and was en route to the wash point. The policy is to have the third party fasten the seat belt to the floor rings and strap himself in. No one checked prior to takeoff to see if this had been accomplished. It is questionable whether the gunner was strapped in or not, as no seat belt was located in the debris.

"Witnesses established the fact that a clearly audible sound had attracted their attention to the aircraft and the engine had failed." [Note: The engine was forwarded for a teardown analysis, but the report of this analysis is not yet available. The maintenance officer suspected failure of the No. 1 or No. 2 bearings of the compressor section, or the sun gear on the reduction gear assembly.]

"The pilot did not cope successfully with a situation in which he could reasonably have been expected to land with little or no damage. He maintained his downwind heading and made no attempt to turn into the wind which was to his right rear, or to turn to a relatively cleared area also to his right and parallel to the flight path within 50 meters. . . .

"Recommendation: Training to include power recovery autorotations at the discretion of IPs to evaluate area selection."

Unit commander's letter of transmittal: ". . . I concur with the findings and recommendation of the board. . . . I have directed that:

"All aviators in this organization will perform practice autorotations with an IP, if they have not done so within three months.

"All aviators in this organization who have less than 500 hours as a rated aviator will perform practice autorotations until the IP and operations officer are satisfied.

"All pilots in this organization will attend a safety lecture dealing with the procedures involved in this accident."

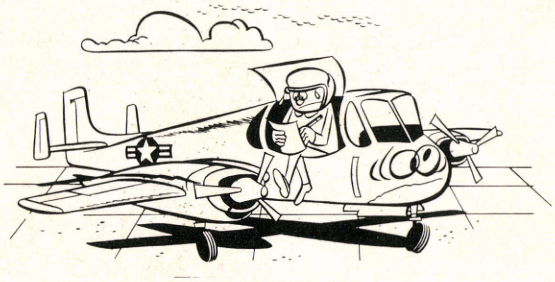
Statement of reviewing official: "Concur with the findings and recommendation of the accident investigation board, and the action taken to prevent recurrence.

"The pilot's low experience, combined with the inoperative condition of the rpm warning device should be considered a possible contributing factor.

"Both the pilot and crewchief lost their helmets during the crash sequence. This loss emphasized the need for an improved helmet retention system. As an interim measure, all crewmembers have been advised to inspect their helmets for fit and security.

"The requirements that all crewmembers have a seat and wear the seat belt, helmet, and gloves have been re-emphasized throughout the command."

[Note: The pilot had been a rated aviator for nine months before the accident. He had a total of 493 flying hours, of which 271 were in UH-1 aircraft. DA Form 2408-13 showed that the rpm warning system had been inoperative for 9 days prior to the accident.]



Reader Survey Responses

THE EFFORTS of our survey published as a page in the June 1966 issue of the DIGEST have paid off. During the period 1 June through 31 August 1966 the tear-out sheets were returned to the DIGEST office. While we had hoped for greater response from readers, the response we did receive has given the staff a better perspective of our publication. We have carefully noted the many recommendations which were made and we hope to use them to produce a magazine more fitted to your needs.

Of the responses, 5 percent were civilians, 26 percent were enlisted men of all grades, 12 percent were warrant officers, 32 percent were company grade officers, and 25 percent were field grade officers. Of the officers who responded 79 percent were rated aviators. Further, 29 percent were fixed wing qualified, 13 percent were rotary wing qualified and 58 percent were dual rated. The average educational level of readers proved to be 14.8 years.

We were extremely delighted to note that of seven military oriented publications listed, the DIGEST was the one most read. The DIGEST was chosen as the best magazine in its field. Such reasons as these were given: well written, current information, broad coverage, etc.

While the DIGEST is not directive in nature, 82 percent stated that the publication helped them in their work.

Several comments were on distribution. The DIGEST is distributed under the pinpoint system; i.e., it is sent out directly from the printer to all units who have requested it. If your unit is getting fewer copies than needed, make it known by submitting a revised DA Form 12-4 to the Co. AG Publications Center, 2800 Eastern Boulevard, Baltimore, Md., 21220.

The material presently being covered in the DIGEST, according to the responses, is satisfactory, although several comments were directed toward increasing coverage in the roles and missions, maintenance, and research and development areas.

DIGEST writing style was considered good by most readers. Sixty-three percent said that it was easy to understand and interesting and clear. We hope to continue to maintain balanced presentation.

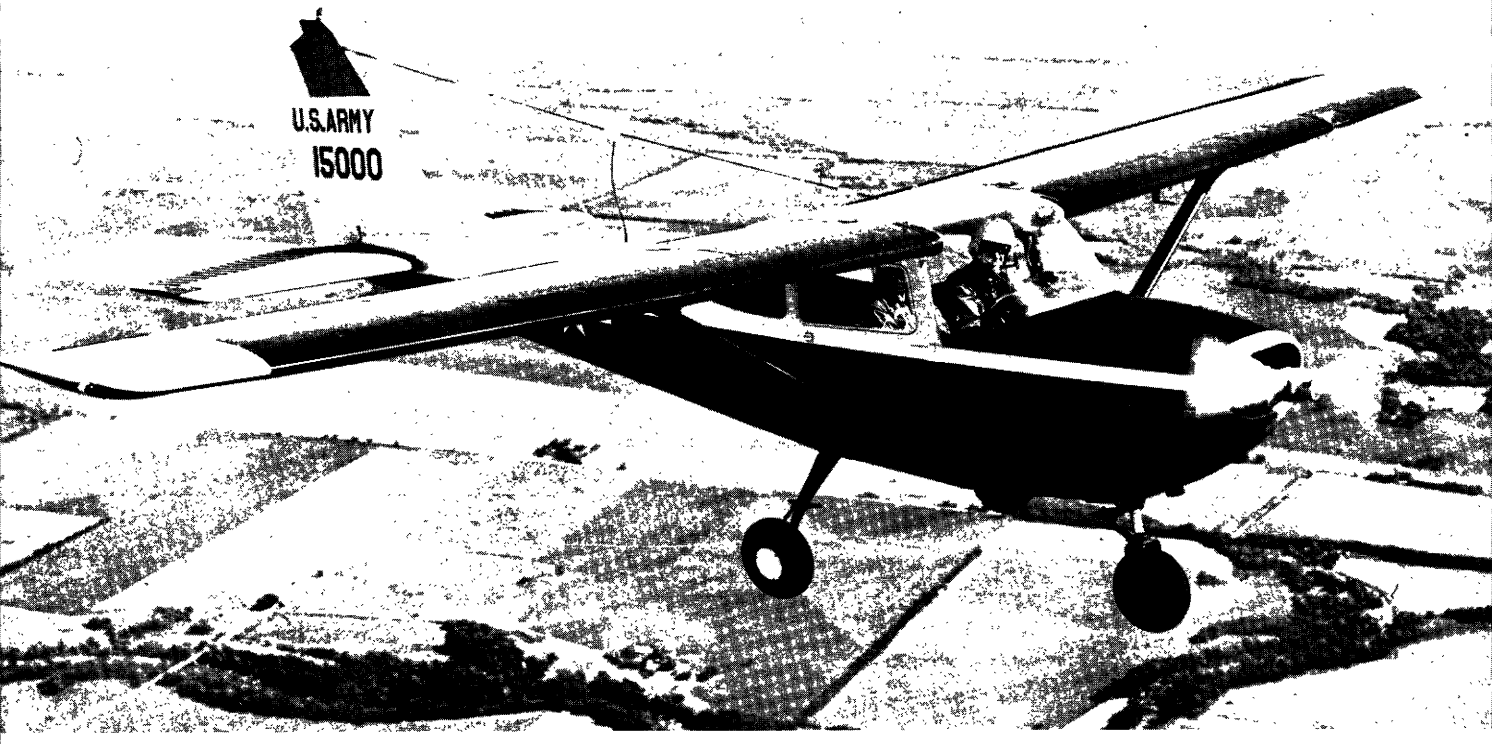
Sixty-eight percent of you stated that you would consider writing for the DIGEST. The most prevalent reason as to what would prompt writing for the magazine was "if I had something to offer." If you are interested in any aviation related subject, we'd like very much to have your contribution. Just mail your story to the Editor-in-Chief, U. S. ARMY AVIATION DIGEST, Fort Rucker Ala., 36360.

Comments in the DIGEST's favor were well received by the entire editorial staff. Some of these were "good coverage, well written, informative and timely." The weak points were also well received. Some were "weak article coverage, dull and dry material, too much about accident analysis." Opinions were varied as to strong and weak points.

Recommendations for improvements were numerous. Those included "broader coverage, more research and development, more Vietnam articles, larger magazine (note this issue is 64 pages, an increase of 16), more safety, less on accidents, more color, less safety, more awards.

As a result of these recommendations and in an effort to give the reader more interesting and informative articles, we hope to diversify the contents of the issues by encouraging more articles from personnel in the less publicized areas. Also, DIGEST annual awards have increased to $25.00 for the best article of the month in addition to a plaque, and the annual first, second, and third place winners now receive a total of $500.00.

The overall opinion from our readers stated that the magazine was excellent. We have derived new areas for exploitation from the survey for which we thank all those who responded. You are encouraged to contribute an article for publication in your magazine whenever you feel you have something to say. We of the DIGEST staff are eagerly awaiting your contribution.



T-41B — ON THE WAY

NEW T-41Bs are pouring off the assembly line and are being delivered to training units and installations throughout the United States. All 255 of the present contract should be delivered by mid-March.

The T-41B replaces the O-1 in the training and troop support roles. It's an off-the-shelf version of Cessna Model 172. It has a constant speed prop, a top speed of 153 mph and a cruise speed of 148 mph.

Takeoff distance over a 50-foot obstacle is 1,045 feet and landing distance over the same obstacle is 860 feet.

Gross weight of the new aircraft is 2,500 pounds. It's equipped with four individual seats and shoulder harness for front seat occupants. The T-41B has a heavier nose gear than its civilian counterpart, enabling it to use rough combat type fields.

All transmitter, receiver and interphone audio is handled by a system comprised of three C-1611 C/A1c interphone sets and three head microphone assemblies. One headset and interphone set is mounted to each pilot and copilot position while a third interphone system is accessible to rear passenger seats. Both control wheels have microphone buttons for audio communication.

Other communication and navigation equipment in the T-41B includes an RT-SIR-1 VHF nav/com radio with a VOR course deviation indicator, AN/ARN-83 low frequency automatic direction finder, BEI-901C emergency VHF transceiver with a single channel on 121.5, and provisions for an AN/ARC-54 FM radio for air-to-air and air-to-ground military communication.

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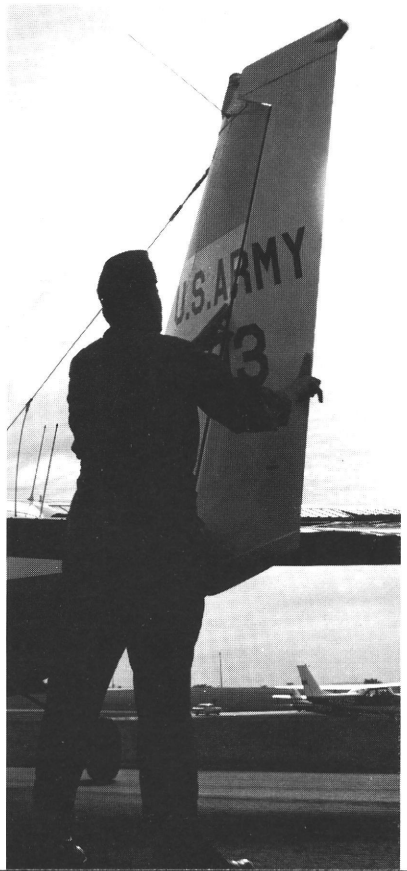

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